INDIA RUBBER WORLD

OUR 64th YEAR

A BILL BROTHERS PUBLICATION

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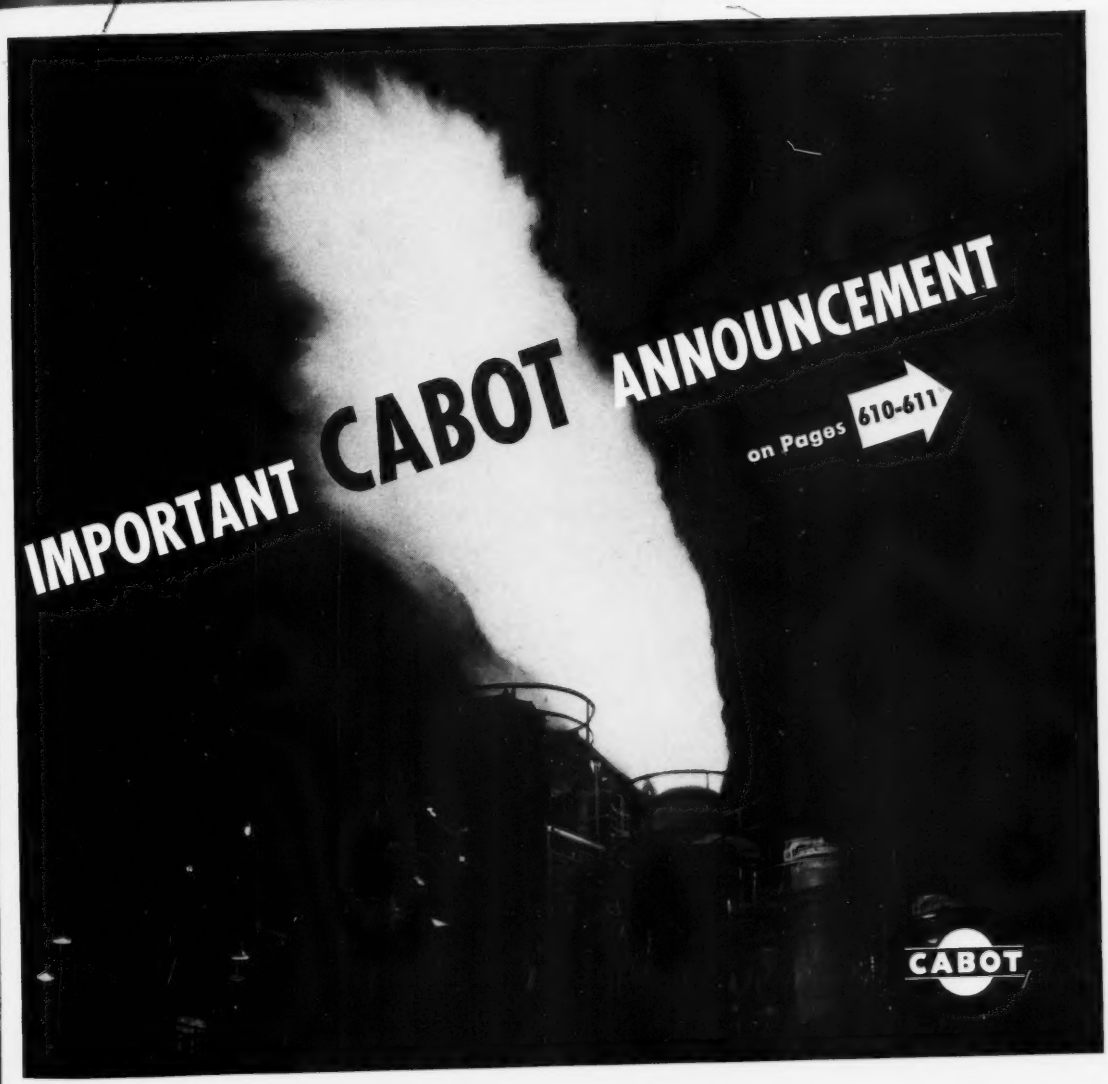
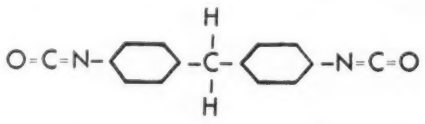
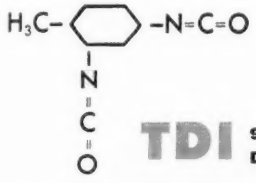


DIISOCYANATES

are highly active

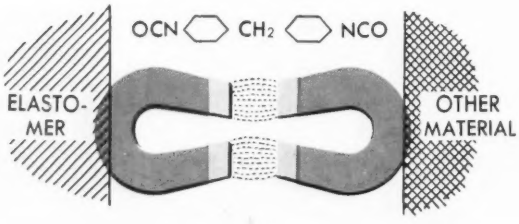


MDI 92%–95% METHYLENE BIS (4 PHENYL ISOCYANATE)



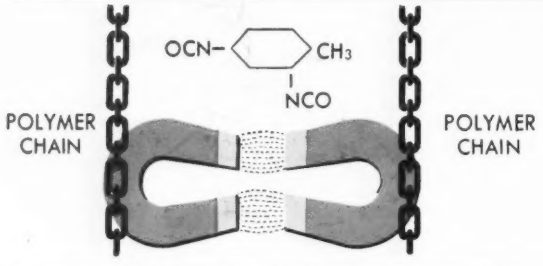
TDI 99% TOLUENE DIISOCYANATE

Their NCO groups will react with almost any reactive hydrogen. Both NCO groups on MDI are of equal reactivity. In TDI, the ortho group is more reactive than the para group.



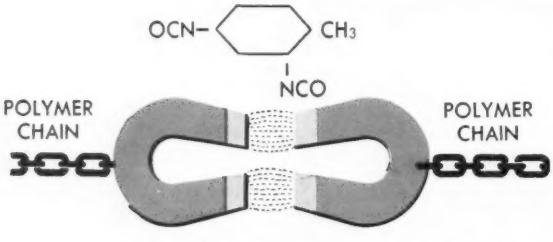
USE MDI—FOR BONDING

MDI added to elastomeric cements will improve adhesion of fabrics, glass, wood, leather, certain plastics and other materials to elastomers and to each other.



USE TDI—FOR CROSS LINKING

The utility of TDI as a cross linking agent is dependent on its chemical reactivity. It will react with any compound containing an active hydrogen; for example, water, amines, alcohols, esters, ketones and organic acids.



USE TDI—FOR EXTENDING POLYMER CHAINS

Polyesters and/or polyether glycols may be made into polyurethanes, polyureas or mixtures of these two with a wide range of thermoplasticities. Chain extension takes place easily.

For more information about these highly active diisocyanates, contact your Du Pont representative.

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DU PONT

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BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

INDIA RUBBER WORLD, February, 1953, Vol. 127, No. 5. Published monthly by BILL BROTHERS PUBLISHING CORP. Office of Publication, Orange, Conn., with Editorial and Executive Offices at 386 Fourth Avenue, New York 16, N. Y., U.S.A. Entered as Second Class Matter at the Post Office at Orange, Conn., under the act of March 3, 1879. Subscription United States and Mexico, $5.00 per year; Canada $6.00; All Other Countries $7.00; Single Copies 50 cents. Address Mail to N. Y. Office.

Another new development using

B. F. Goodrich Chemical *raw materials*

Arrows show use of Hycar rubber in typical mountings.

Accounting machine manufactured by The National Cash Register Co., Dayton, Ohio. B. F. Goodrich Chemical Co. supplies the Hycar rubber only.

Where smooth operation is needed—

HYCAR'S THE ANSWER!

HERE'S the newest all-purpose National Accounting Machine that marks a big step forward in automatic accounting. For even with its many mechanized features, vibration is reduced to a minimum, thanks to Hycar's help. Ten brackets and mountings, containing Hycar rubber, are strategically placed to absorb shocks and effectively reduce machine vibration.

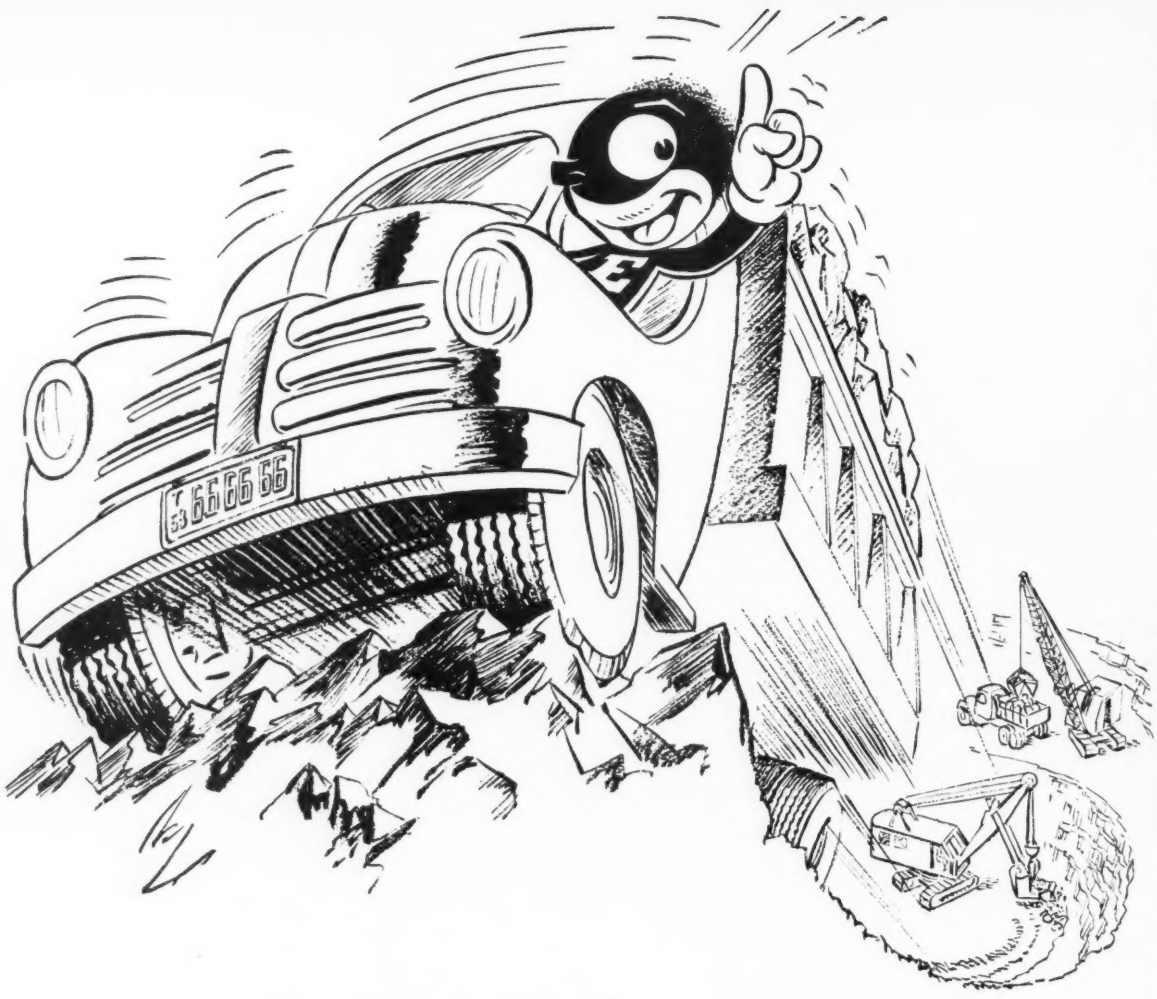
That's just one advantage Hycar gives the machine *and* the manufacturer. Hycar also resists the deteriorating effects of lubricating oils and greases used on office machinery. It won't harden or lose its resilience with age. The Hycar rubber is easily molded onto metal machine supports or other vital operating parts. And it will not distort or change shape when tightened in place.

What can Hycar do to help you improve or develop products to bring in more sales? Hycar rubber compounds resist heat and cold, gas, oil, aging, abrasion and many chemicals. For helpful technical information, please write Dept. HA-2, B. F. Goodrich Chemical Co., Rose Bldg., Cleveland 15, Ohio. Cable address: Goodchemco In Canada: Kitchener, Ontario.

B. F. Goodrich Chemical Company
A Division of The B. F. Goodrich Company

Hycar
Reg. U. S. Pat. Off.
American Rubber

GEON polyvinyl materials • HYCAR American rubber • GOOD-RITE chemicals and plasticizers • HARMON organic colors



New **Philblack*** **E** *is really super!*
Abrasion resistance? Super duper!

Longer mileage than ever before! That's the record made by cold rubber tire treads with Philblack E . . . under severe road test conditions! Yes, 35% to 42% better than HAF black, in tests on passenger cars!

And in natural rubber truck tire treads, this SAF black proved to be 12% to 24% better than EPC black.

This superior wear resistance Philblack E gives is combined with outstanding protection against cut and crack growth. These two qualities make Philblack E especially valuable for tire treads, industrial belts, and other products that must stand up under severe conditions. It beats any black previously marketed!

For full information, consult our technical sales representative who calls on you or write our nearest office.

PHILLIPS CHEMICAL COMPANY

PHILBLACK SALES DIVISION

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PHILBLACK EXPORT SALES DIVISION • 80 BROADWAY • NEW YORK 5, N. Y.

* A Trademark

Philblack E, Philblack O and Philblack A are manufactured in Borger, Texas. Warehouses in Akron, Boston, Chicago and Trenton. West Coast agent: Harwick Standard Chemical Company, Los Angeles. Canadian agent: H. L. Blachford, Ltd., Montreal and Toronto.

Rubber really

Here's a general toner for natural and synthetic rubber products that keeps them alive and on-the-go for years.

Body-building Tonox®—

- **improves abrasion resistance.**
- **reduces build-up of heat from flexing.**
- **prevents deformation, sagging, and distortion of unvulcanized stocks.**
- **reduces softening of butyl rubber tire curing bags.**
- **accelerates vulcanization of Neoprene.**
- **ends frosting in vulcanized natural rubber.**

Tonox has proven its ability to lengthen rubber life in hundreds of products, from heavy-duty tire carcass and treads to light, tough footwear.

Supplied in waxlike lumps, Tonox disperses readily and is a strong activator. It has good storage stability and requires no handling precautions.

Find out more about how Tonox can improve the tone of *your* product. For a valuable comprehensive report on Tonox, its properties and compounding, send the coupon below today.

Division of **UNITED STATES RUBBER COMPANY** • Naugatuck, Conn.

IN CANADA: NAUGATUCK CHEMICALS DIVISION
Dominion Rubber Company, Limited, Elmira, Ontario

Rubber Chemicals • Aromatics • Synthetic Rubber • Plastics • Agricultural Chemicals
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Naugatuck Chemical, 132 Elm Street, Naugatuck, Conn.
Please send Compounding Research Report No. 21 on Tonox to:

Name.....
Title.....
Company.....
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SAVE PROCESSING DOLLARS...

IMPROVE PRODUCT QUALITY...

with PROTOX* ZINC OXIDES

You cut your mixing and tubing costs, and step up the quality of your products, when you switch to Protox oxides.

The reason is this: Protox oxides process easier and disperse better . . . because their exclusive patented coating of zinc propionate serves both as a processing aid and as a dispersing agent.

Your savings and improvement in product quality are in proportion to the percentage of Protox you use on the rubber.

SAVE ON MIXING COSTS

Save Time

Protox oxides incorporate faster
. . . in any weather, in any type of rubber
. . . turn out more batches per day

Save Power

Protox oxides mix easier
. . . cut power consumption
. . . reduce power surges, cut penalty payments

SAVE ON TUBING COSTS

Save Time

Protox oxides tube smoother, faster
. . . reduce strainer down-time as aggregates are fewer

IMPROVE PRODUCT QUALITY

Improve Activation

Protox oxides disperse better
. . . increase activation efficiency

Improve Tear Resistance

Protox oxides impart higher tear strength
. . . provide more effective surface area
. . . give more freedom from aggregates that act as tear centers

Improve Other Physicals

Protox oxides give higher modulus and tensile
. . . provide more effective surface area

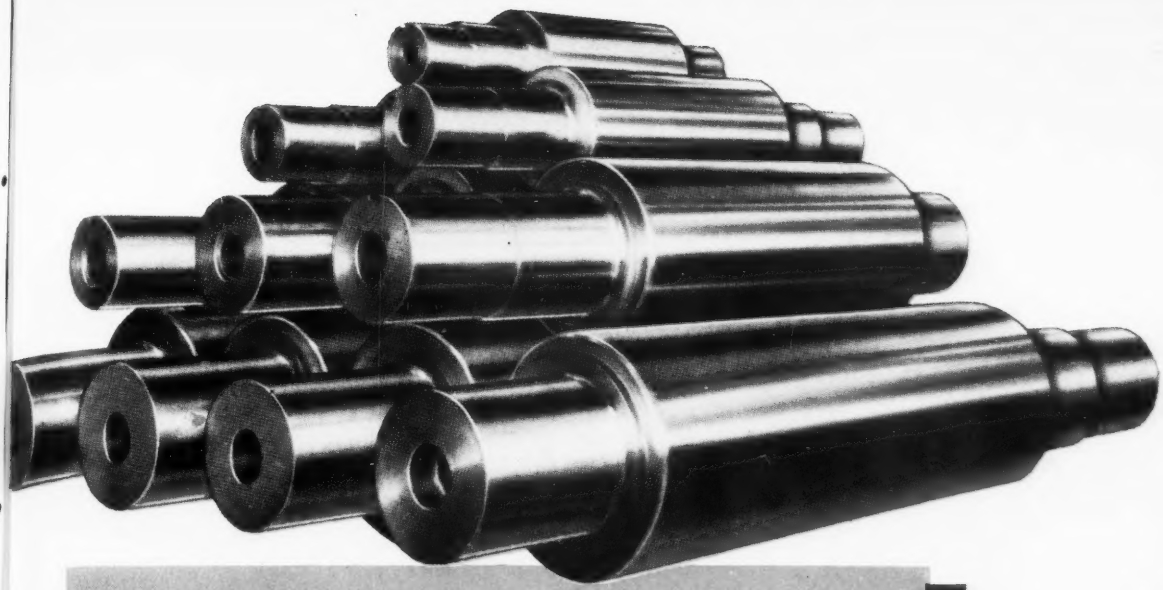
*U.S. Patents 2,303,329 and 2,303,330

THE NEW JERSEY ZINC COMPANY

Producers of Horse Head Zinc Pigments

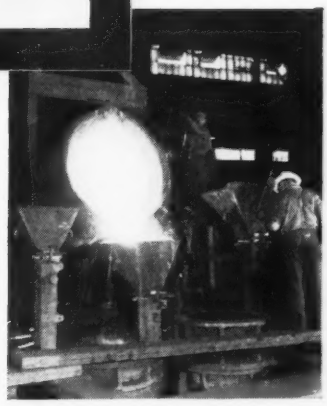
. . . most used by rubber manufacturers since 1852

160 Front Street, New York 38, N. Y.



TO BE *SURE*

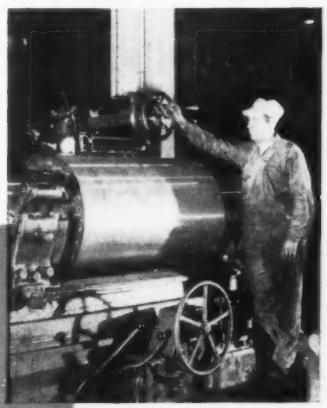
WE MAKE OUR OWN ROLLS



Physical and metallurgical properties of rubber or plastics processing rolls frequently need to be varied to meet special conditions peculiar to the nature of the work to be performed and the requirements of the finished product. That's why the rolls used in Adamson United equipment are custom designed to their specific functions by our own engineers and carefully controlled through every step of manufacture from metallurgical composition to final machining and polishing, in our own roll shops. We have found this precision-minded policy—typical of every phase of Adamson United manufacture—to be our best assurance of customer satisfaction.

Our engineering abilities and plant facilities are available to the industry for the design, construction and installation of all types of rubber or plastics processing equipment.

We invite your correspondence.



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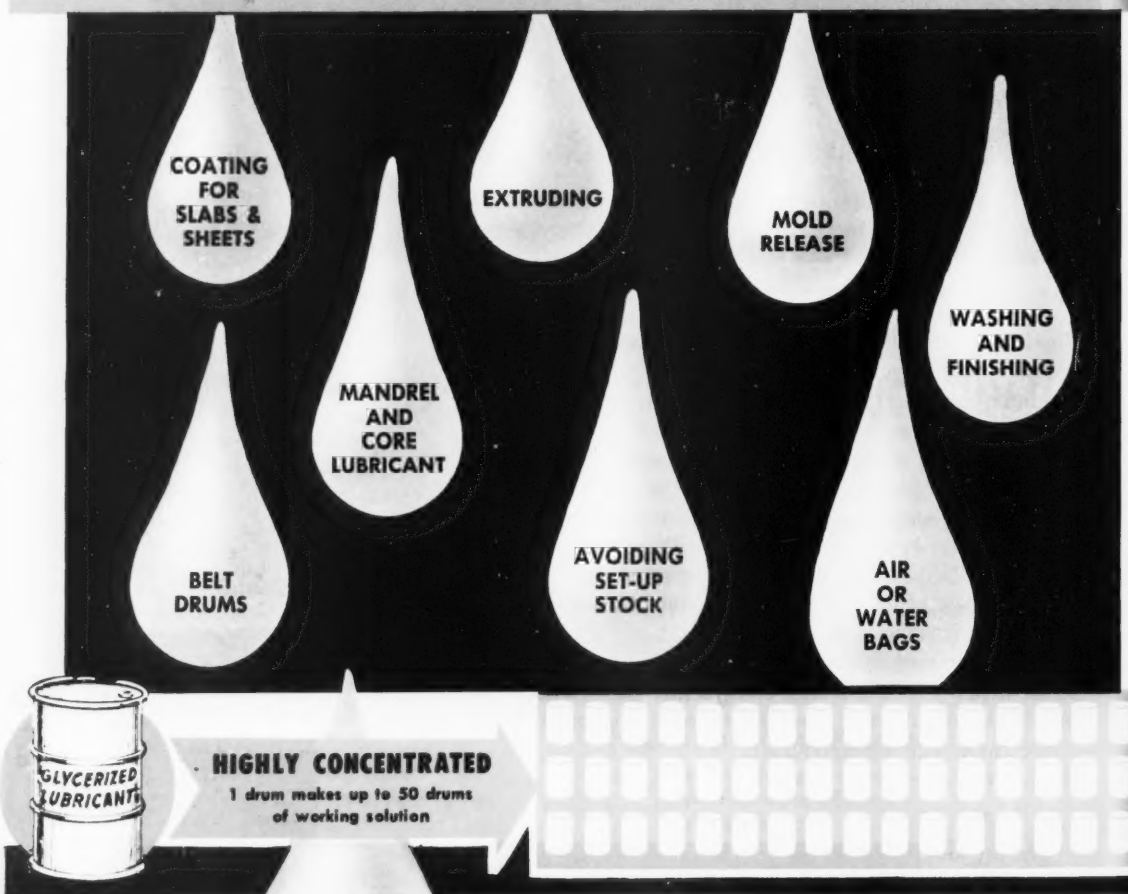
LIQUID LUBRICANT

AN ALL PURPOSE RUBBER LUBRICANT FOR
NATURAL—SYNTHETIC AND RECLAIM STOCKS



HIGHLY CONCENTRATED
1 drum makes up to 50 drums of working solution

QUALITY SINCE 1884

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RUBBER MATERIALS DIVISION

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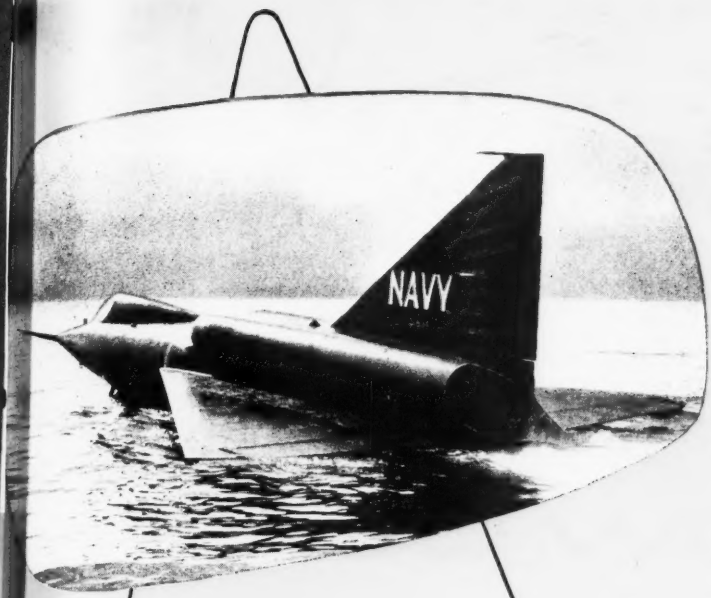

IN AVIATION . . .

Another new advancement in aeronautical design. The world's first delta-wing jet seaplane, the Navy's Convair "Sea-Dart", launched recently in San Diego Bay.

PROGRESS

IN THE RUBBER INDUSTRY . . .

Muehlstein as a leading supplier, has for over forty years continued to advance the standards of service, through progressive business methods and constantly increasing efficiency of operation.

H. MUEHLSTEIN & CO. INC

60 EAST 42ND STREET, NEW YORK 17, NEW YORK

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CRUDE RUBBER, SYNTHETIC RUBBER, SCRAP RUBBER, HARD RUBBER DUST, PLASTICS

HIGH QUALITY at LOW COST

for reinforced polyesters

If you're seeking ways to get better polyesters at low cost, let us recommend the right DIAMOND Precipitated Calcium Carbonate for your product.

You'll get smoother surfaces, no cracks, no evidence of glass fibers when DIAMOND Carbonates are mixed with catalyzed, glass-reinforced polyesters. And your product gets improved wet strength and reduced shrinkage.

All these at lower volume cost.

DIAMOND offers these precipitated calcium carbonates for reinforced polyesters:

Surfex® MM—coated with 1% resin; particle size about 5 microns.

Suspenso®—same as Surfex MM, but uncoated.

Kalite®—coated with 1% stearic acid; size about one micron.

Multifex® MM—uncoated; particle size about .06 micron.

Write for DIAMOND technical bulletin: *The Use of Precipitated Calcium Carbonates in Reinforced Plastics.*

DIAMOND SALES OFFICES: New York, Philadelphia, Pittsburgh, Cleveland, Cincinnati, Chicago, St. Louis, Memphis, Houston.

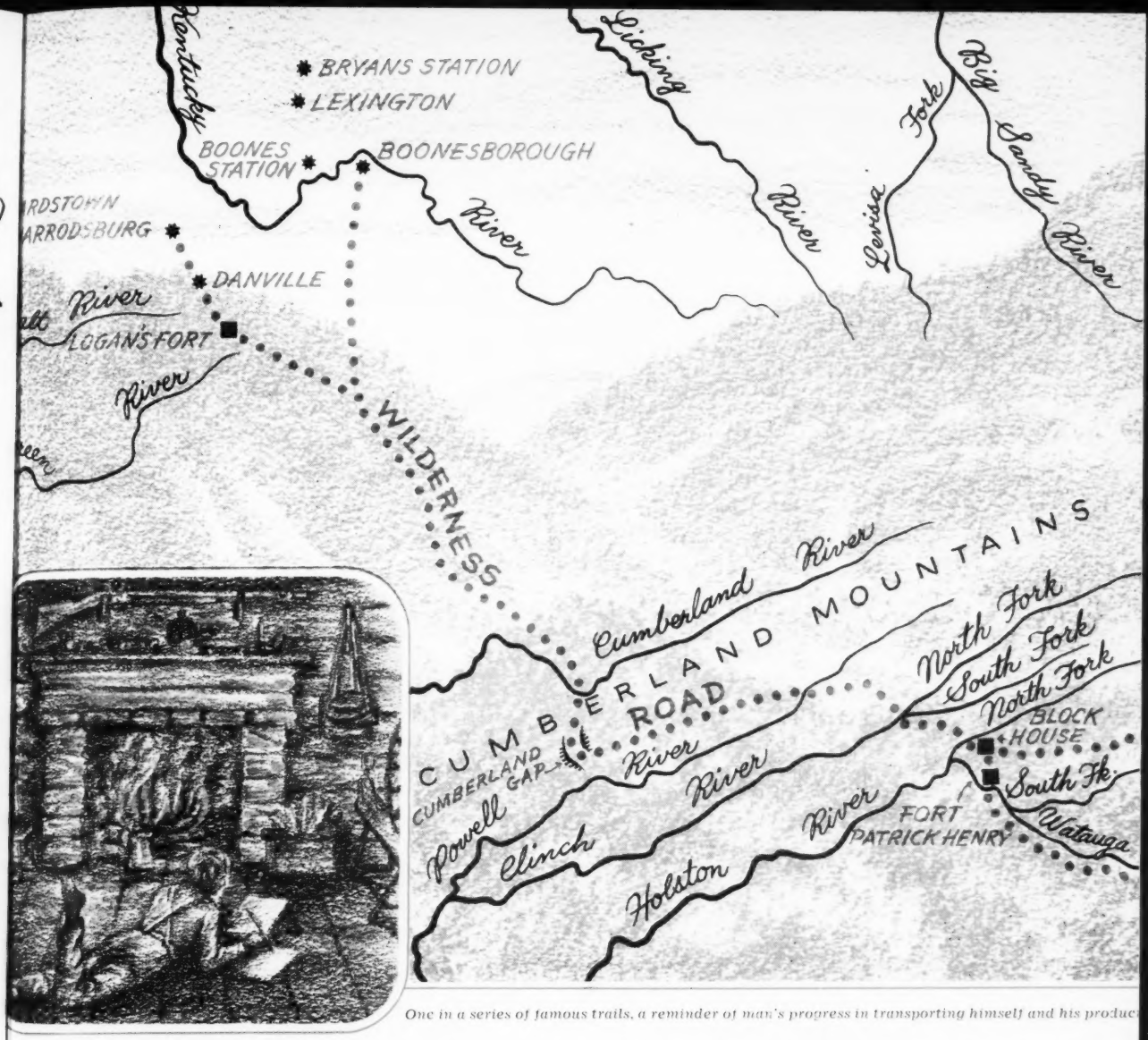
DISTRIBUTORS OF THESE PRODUCTS: C. L. Duncan Co., San Francisco and Los Angeles; Van Waters and Rogers, Inc., Seattle and Portland, U. S. A.; Harrisons & Crosfield (Canada) Ltd.

DIAMOND ALKALI CHEMICALS ®

DIAMOND CHEMICALS

FOR THE RUBBER AND PLASTICS INDUSTRIES

DIAMOND ALKALI COMPANY...CLEVELAND 14, OHIO



One in a series of famous trails, a reminder of man's progress in transporting himself and his product

WILDERNESS ROAD

1775, Daniel Boone and 30 men set out from Virginia pen the way into Kentucky, carrying with them rifles protection and axes for chopping trees and under- h. From the Cherokee Indians the Transylvania Com- had purchased, at a cost of 10,000 pounds of trade s. 20 million acres of land. The "Wilderness Road," t Boone and his 30 men opened, provided access for ers who would travel its length from the Appalach- over the Warrior's Path, through Cumberland Gap, s fertile lands of the "dark and bloody ground."

the year 1809, in a small log cabin in this area which Wilderness Road had opened for settlement, there born to Thomas Lincoln and his wife, Nancy Hanks ln, a son whom they named Abraham after his father. Grandfather Abraham had brought his wife heir family of five children out to Kentucky from nia in 1782, following the trail of his good friend insman, Daniel Boone.

How narrow must have been the road cleared by Boone and 30 men; how great must have been the toil and labor for those who journeyed over it. Today the wilderness is no obstacle for those who build highways. With his powerful equipment, man opens the way through forests and over mountains. On this equipment is the rubber tire, equal to the weight placed upon it and the rough terrain over which it must roll.

How far man has progressed in his ability to transport himself and his products, and to build the highways over which he travels. Given the need, he masters the way. Carbon black has given strength and durability to the rubber tire, whether it is used in moving rock and earth or in transporting a family on a week-end trip. To its carbon blacks, UNITED CARBON COMPANY has provided for more than a quarter of a century an engineering and scientific skill which places them in the forefront of "rubber blacks."

UNITED CARBON COMPANY, INC.

We furnish the rubber industry with these well-known carbon blacks of outstanding quality —

UNITED BLACKS

Dixie 20 - - - -	SRF	Semi-Reinforcing Furnace
Dixie 40 - - - -	HMF	High Modulus Furnace
Dixie 50 - - - -	FEF	Fast Extrusion Furnace
Dixie 60 - - - -	HAF	High Abrasion Furnace
Dixiedensed S - -	HPC	Hard Processing Channel
Dixiedensed HM	MPC	Medium Processing Channel
Dixiedensed S-66	MPC	Medium Processing Channel
Dixiedensed 77 -	EPC	Easy Processing Channel

UNITED BLACKS

Discerning rubber compounders obtain their excellent results in a variety of stocks when using our quality blacks.

UNITED CARBON COMPANY, INC.

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NEW YORK AKRON CHICAGO BOSTON
CANADA: CANADIAN INDUSTRIES, LTD.

Experience, a necessary ingredient in the manufacture of any product, is especially essential in roll making where only by long and intimate association with an industry, can its requirements be thoroughly understood and successfully provided for.

To United's 50 years of roll making experience can be added the advantages of its continuing program of metallurgical research, basically sound engineering and modern production facilities—a combination that made, and has kept, United Rolls favorites in outstanding processing plants throughout the world.

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When in need of rolls—for whatever requirement—consult us.

UNITED ENGINEERING AND FOUNDRY COMPANY
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Subsidiaries: Adamson United Company, Akron, Ohio
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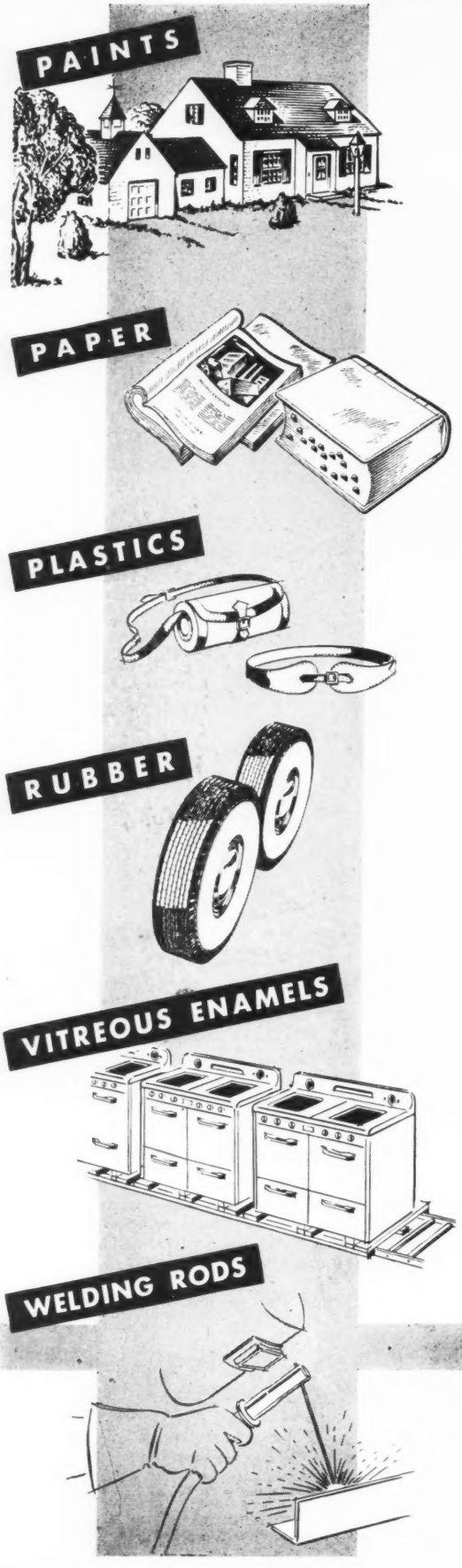
Designers and Builders of Ferrous and Non-Ferrous Rolling Mills, Mill Rolls, Auxiliary Mill and Processing Equipment, Presses and other heavy machinery. Manufacturers of Iron, Nodular Iron and Steel Castings and Weldments.



LOOK TO TITANOX FOR TiO_2 TECHNICAL SERVICE

New Applications . . .

Take them to Titanox Technical Service

Skilled technologists and the most modern facilities for research and development are available through Titanox Technical Service for the investigation of new uses for titanium dioxide and titanium compounds. The recent introduction of TITANOX-TG, prime source of *non-pigmentary* TiO_2, makes titanium dioxide available in greater quantities and in a more usable form for the manufacture of improved enamels, heat resistant coatings, glass, welding rod coatings and many other products. New fields of application are now under consideration . . . perhaps Titanox Technical Service can help you.

Improved Formulation . . .

Ask Titanox Technical Service

Long experienced in the formulation of both pigmentary and non-pigmentary titanium dioxide for use in paints, paper, rubber, plastics and ceramics, Titanox Technical Service is always available for assistance with any formulation problem. Often, these specialists can suggest a change or recommend the use of one of the newer Titanox types which may improve your product.

More Efficient Utilization . . .

Check with Titanox Technical Service

For the most efficient use of Titanox pigments, you'll find our Technical Service—with its wealth of laboratory and research data, its years of service experience—can often be helpful to you. Perhaps they can suggest a new or different Titanox product that will speed production or lower costs.

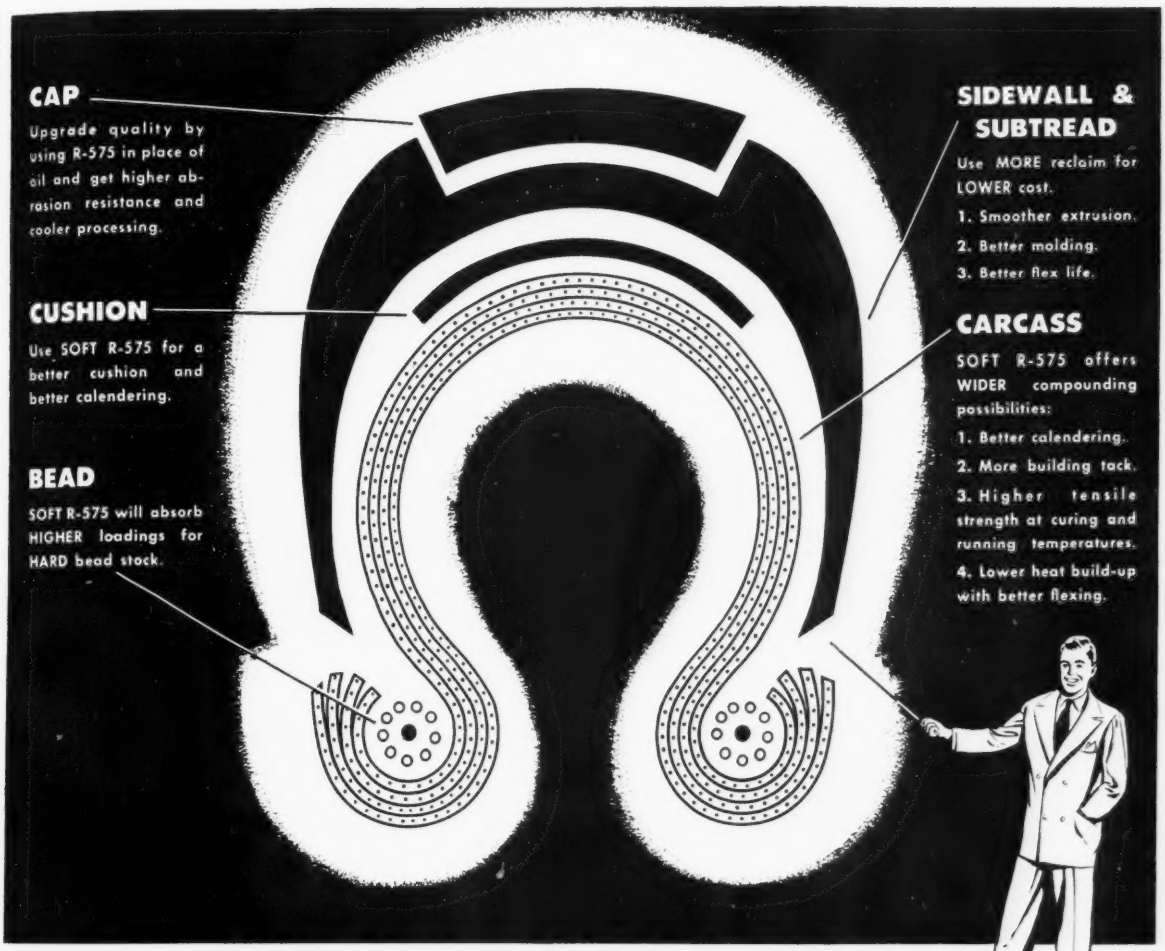
For detailed information on the advantages of Titanox Technical Service, see your Titanox representative or write to the Titanium Pigment Corporation, Dept. WA, 111 Broadway, New York 6, N.Y.

® TITANOX

TITANIUM PIGMENT CORPORATION

Subsidiary of NATIONAL LEAD COMPANY

Make a **BETTER** low-priced tire


CAP
Upgrade quality by using R-575 in place of oil and get higher abrasion resistance and cooler processing.
CUSHION
Use SOFT R-575 for a better cushion and better calendering.
BEAD
SOFT R-575 will absorb HIGHER loadings for HARD bead stock.
SIDEWALL & SUBTREAD
Use MORE reclaim for LOWER cost.
1. Smoother extrusion.
2. Better molding.
3. Better flex life.
CARCASS
SOFT R-575 offers WIDER compounding possibilities:
1. Better calendering.
2. More building tack.
3. Higher tensile strength at curing and running temperatures.
4. Lower heat build-up with better flexing.

. . . with Dip-Process Reclaim R-575

More and more manufacturers of tires are using RECLAIMATOR (Dip) Process Reclaims to produce *better* low-priced tires. As illustrated in the chart above, this versatile reclaim can be used to good advantage in every part of these tires. Plus all these advantages, you'll find that R-575 gives you faster and cooler mixing and larger Banbury batches with lower consumption of power.

In addition, you can use this SOFT R-575 Reclaim in all grades of Camelback that are now in such demand. You'll not only get less nerve but faster and smoother extrusion as well. We'd like the opportunity to tell you about the many advantages that the reclaims made by our exclusive Reclaimator Process can bring to your operation. Drop us a line now for complete details.

Always keep reclaims in your formula and always look to U. S. for the best. U. S. Rubber Reclaiming Company, Inc., P. O. Box 365, Buffalo 5, N. Y. Trenton agent: H. M. Royal, Inc., 689 Pennington Ave., Trenton, N. J.

70 years serving the industry solely as reclaimers

U.S. RUBBER RECLAIMING COMPANY, INC.

Rubber customers bouncing away?

"Alamask" odorants neutralize unpleasant odors . . . help give you rubber products that sell!

More and more people are buying products using foam and sponge rubber—pillows, mattresses, cushions, rugs, shoes. But they're getting something they don't want if they discover the foam or sponge rubber has stored up musty, unpleasant odors.

It's an easy problem to solve, however, for "Alamask" odorants will completely neutralize unwanted off-odors . . . will give your foam and sponge rubber the chance to sell.

Latex manufacturers: Easy-to-use "Alamask" odorants are now available in water dispersible form . . . require no emulsification prior to use.

To find out what "Alamask" odorants can do for you, send for your copy of the booklet "Du Pont 'Alamask' Odorants for the Rubber Industry." Write E. I. du Pont de Nemours & Co. (Inc.), Room 8452 Nemours Bldg., Wilmington 98, Delaware.

District offices: Atlanta, Boston, Charlotte, Chicago, New York, Philadelphia, Providence, San Francisco.

Du Pont **Alamask** Odorants

TRADEMARK

DU PONT

REG. U.S. PAT OFF.

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

125 MILLIONTH POUND of GR-S made with WING-STAY S in 1952 is in this bale shown on its way to packaging.

LAST year WING-STAY S was used to protect more than 125,000,000 pounds of GR-S by incorporation during manufacture—more non-staining GR-S than was protected with all other non-staining antioxidants combined.

Reason why WING-STAY S is the first choice of the rubber industry is its ideal combination of antioxidant protection, non-discoloring and non-staining properties and low cost. Its incorporation—in either natural or synthetic rubbers—means white and light colors that remain unmottled and clean-looking, and rubber protected against oxidation.

For your best protection in 1953, specify WING-STAY S when you buy these GR-S Polymers:

GR-S 1006 hot synthetic rubber
GR-S 1012 hot synthetic rubber
GR-S 1502 cold synthetic rubber
GR-S X-693 oil-extended synthetic rubber

and when using other rubbers, natural or synthetic, incorporate WING-STAY S in your own compounds. Write for further details today to:

Goodyear, Chemical Division, Akron 16, Ohio

Chemigum, Pliobond, Pliolite, Pliovic, Wing-Stay—
T.M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

CHEMICAL
GOODYEAR
DIVISION

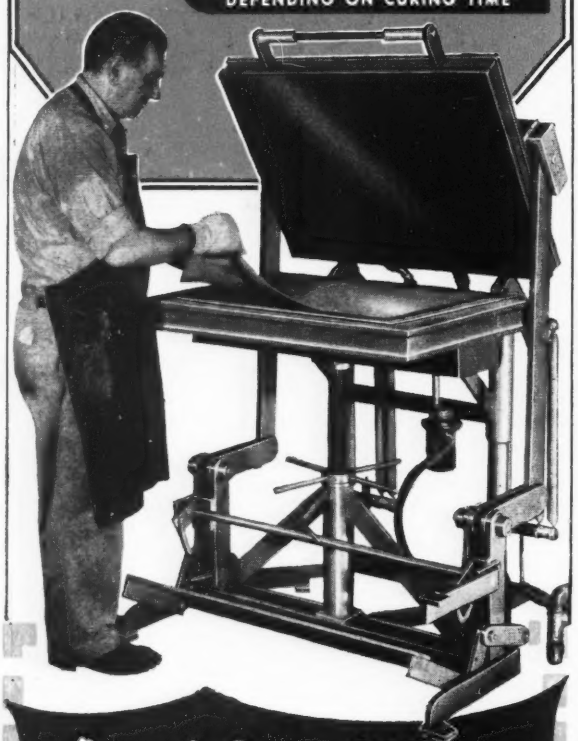
Use-Proved Products — CHEMIGUM · PLIOBOND · PLIOLITE · PLIOVIC · WING-CHEMICALS — The Finest Chemicals for Industry

We think you'll like "THE GREATEST STORY EVER TOLD" — every Sunday — ABC Radio Network — THE GOODYEAR TELEVISION PLAYHOUSE — every other Sunday — NBC TV Network

ONE MAN CAN OPERATE
FROM 1 TO 17 . . .

Holmes

SPONGE RUBBER
VULCANIZING PRESSES
. . . Simultaneously
DEPENDING ON CURING TIME



Original Cost . . . 80% Less

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Solubility	Very Limited
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Taste	None

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VOLUME I

PRIMARY MACHINERY AND EQUIPMENT

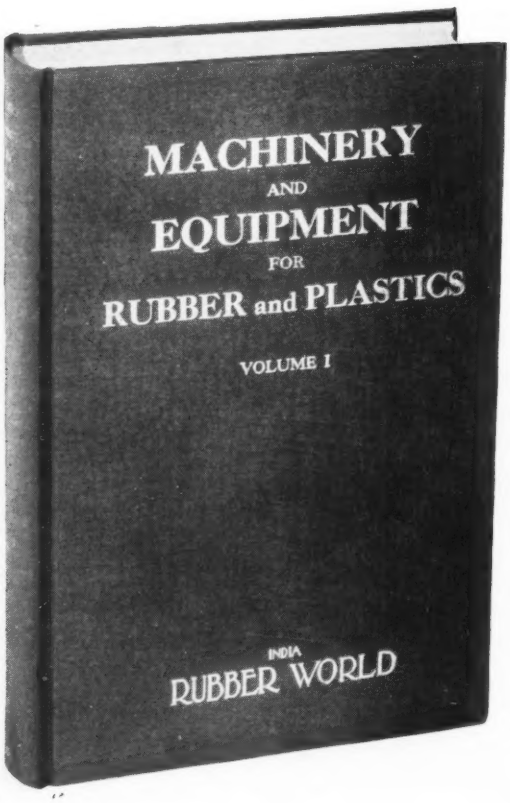

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Table of Contents

Chapter 1. Mills
Chapter 2. Mill Accessories
Chapter 3. Mixers
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Chapter 14. Tire & Tube Machinery
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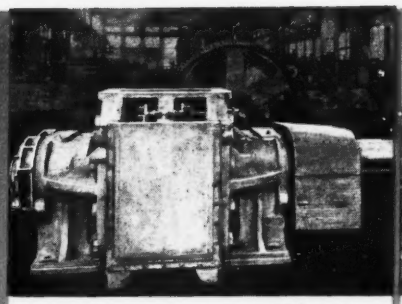
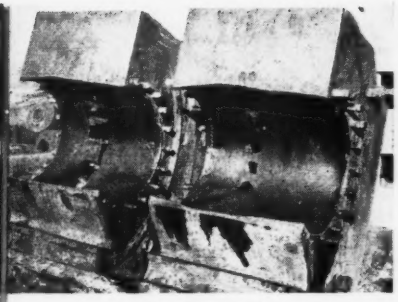
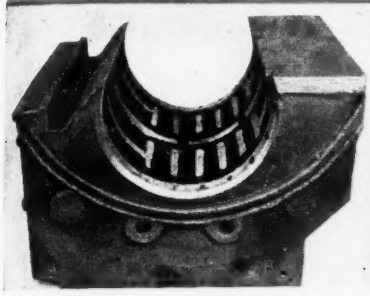


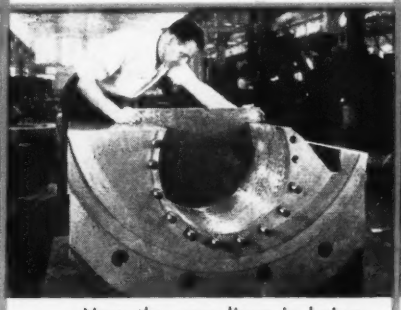
1 As soon as a worn Banbury is received, it is cleaned, dismantled, thoroughly inspected, and magnafluxed for hidden cracks.



2 These sides are very badly worn, but our experts can repair them by inserting new liners.



3 This side has been bored — ready for a new liner to be welded in.

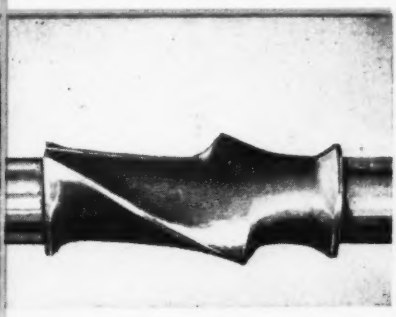


4 Now the new liner is being gauged after having been ground to exact size. The side is now as good as new.

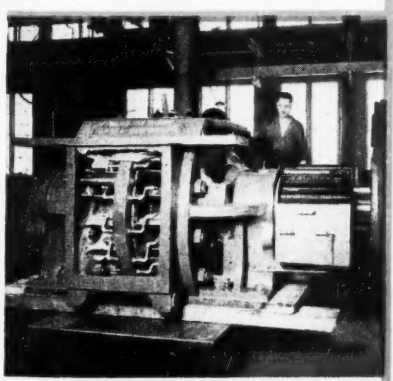
5 Here's a candid shot of a worn rotor. Looks bad — but it's not hopeless.

6 Now the entire rotor has been built up to full original size.

7 With necks rough-machined and body rough-ground, this rotor is now well on the way toward a new life.



8 Here's the rotor with its "new look," all ready for plenty of hard work.



9 And here is the complete rebuilt body, reassembled, tested and ready to leave the shop carrying a new-machine guarantee.

These operations on two of the larger parts are just a few examples of how thoroughly a Banbury mixer body is rebuilt at Farrel-Birmingham. End frames, door top and cylinder, dust stops, thrust collars, connecting gears, and all the other parts also receive careful examination and are either restored to "good-as-new" condition, or, if necessary, replaced.

This work requires the skill, experienced "know-how" and special facilities found only where Banbury mixers are built originally. Why take less than the best? The high quality of Farrel-Birmingham's Banbury repair work cannot be matched at lower prices — or at any price, for that matter.

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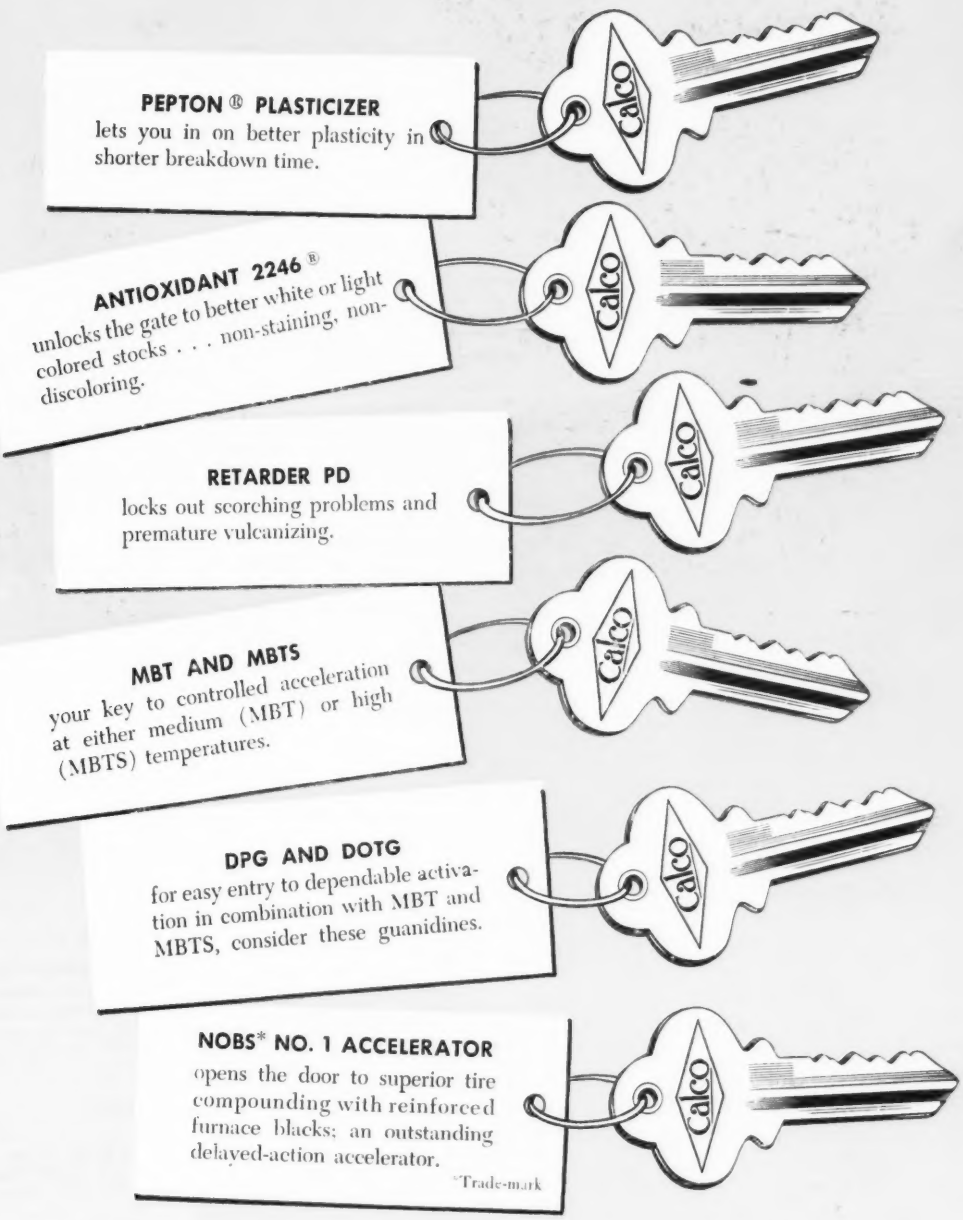

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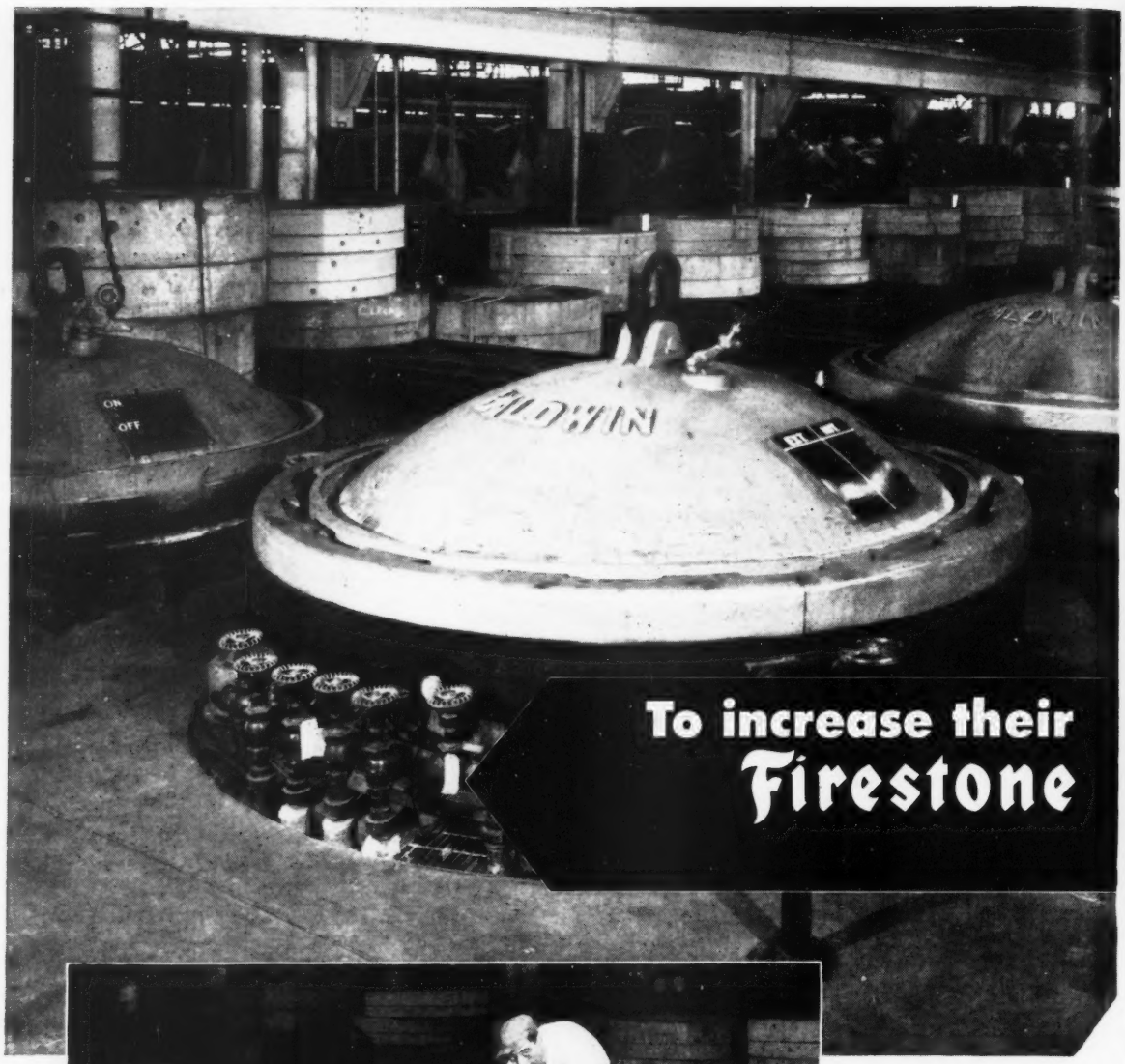
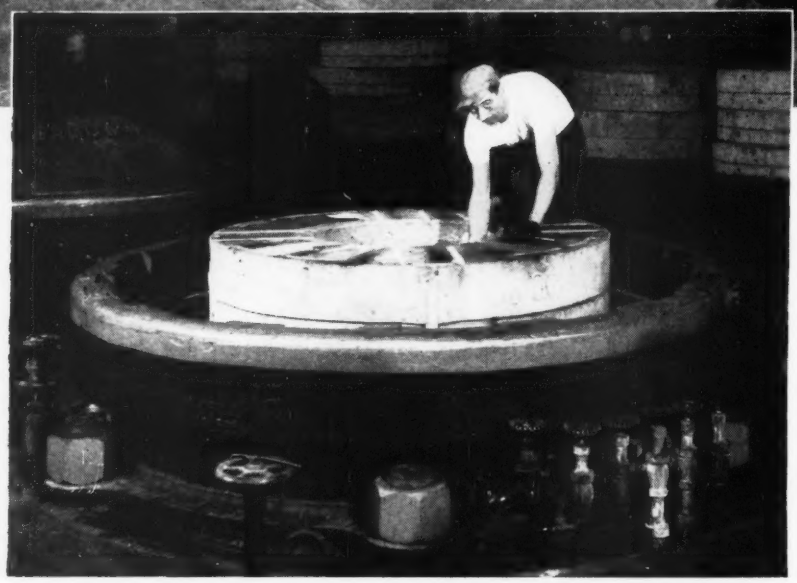


To increase their
Firestone



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- **LESS DOWN-TIME**—because of the sturdier construction of every Baldwin press.
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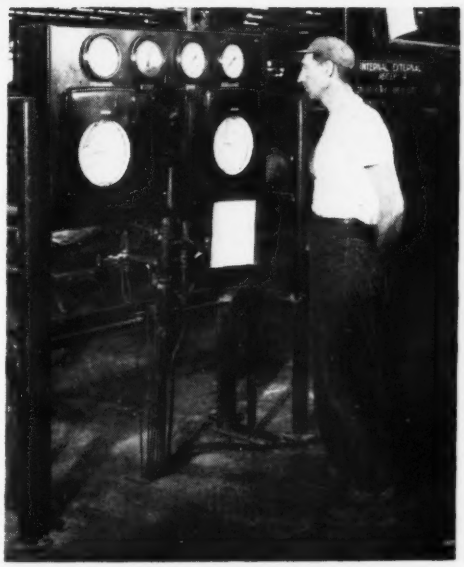

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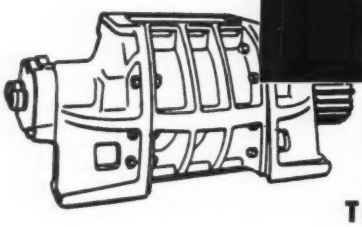

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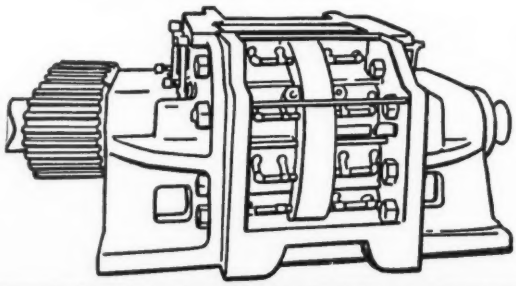

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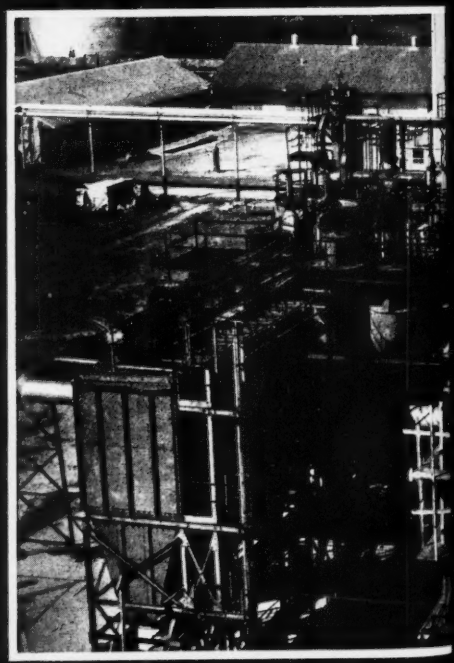

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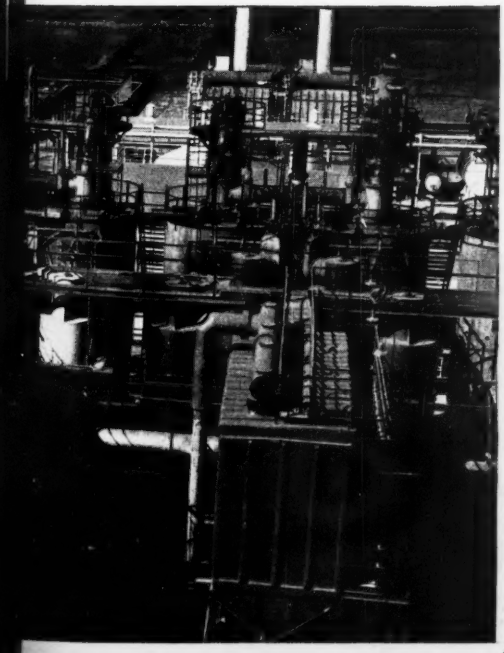

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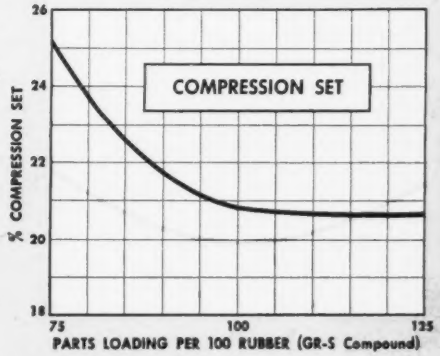

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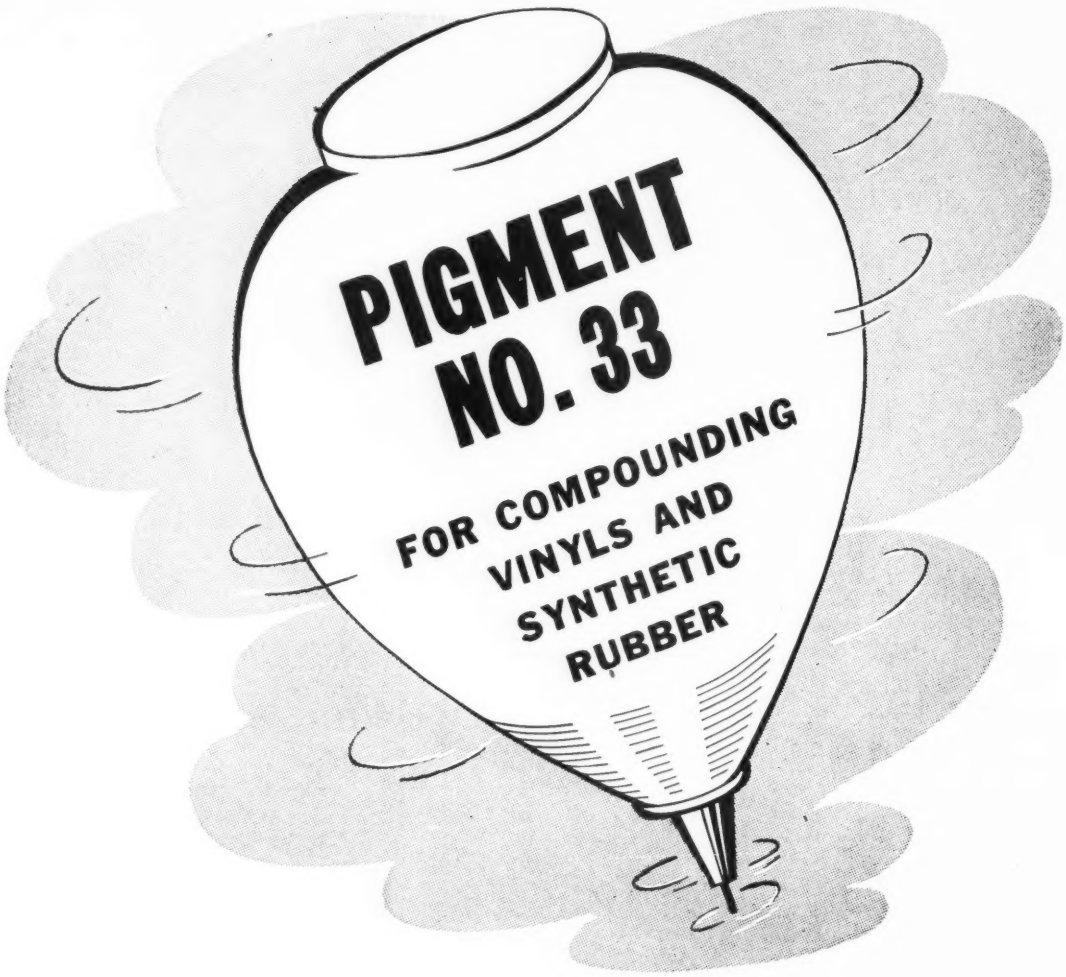

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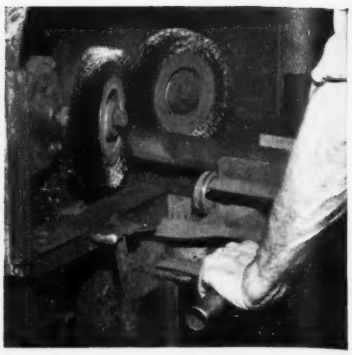

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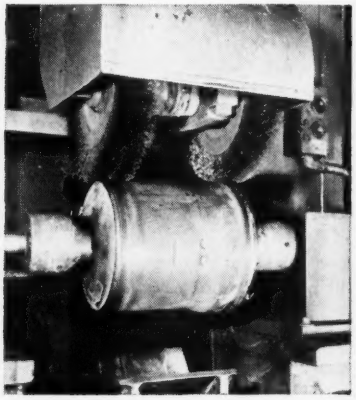

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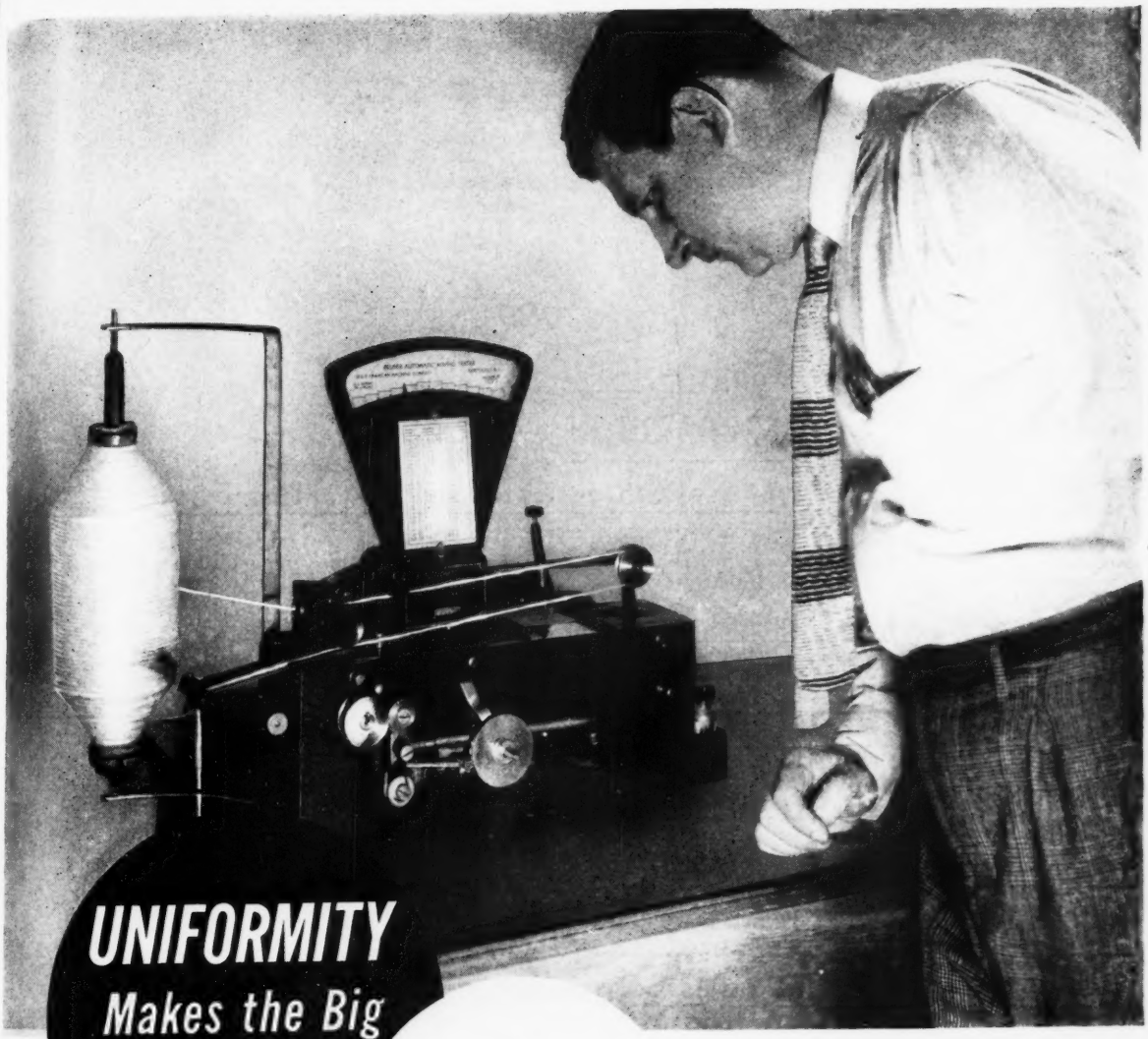

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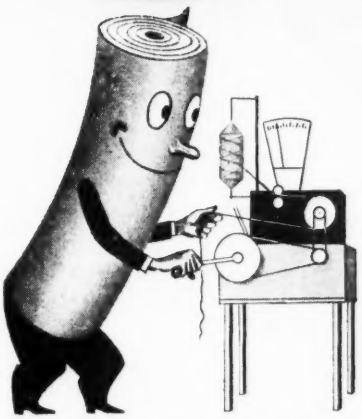

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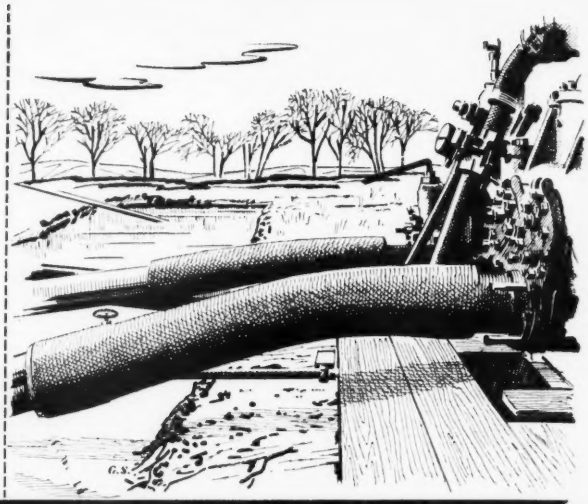

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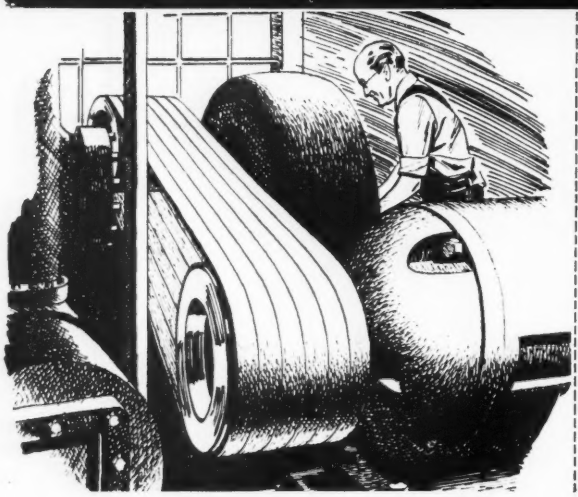

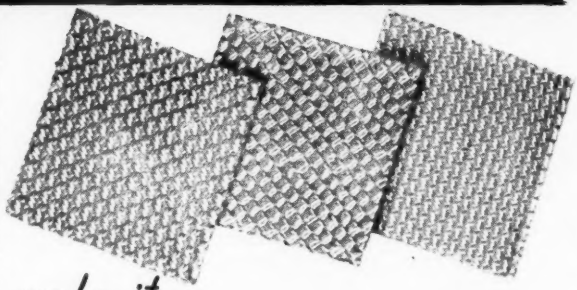

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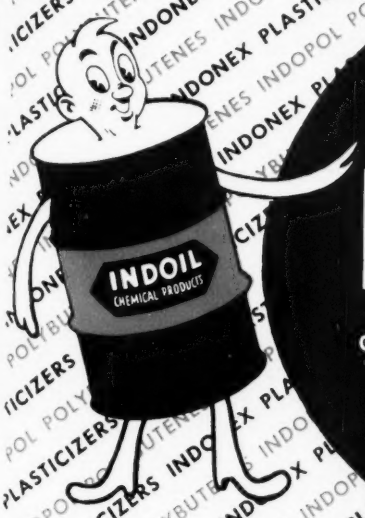

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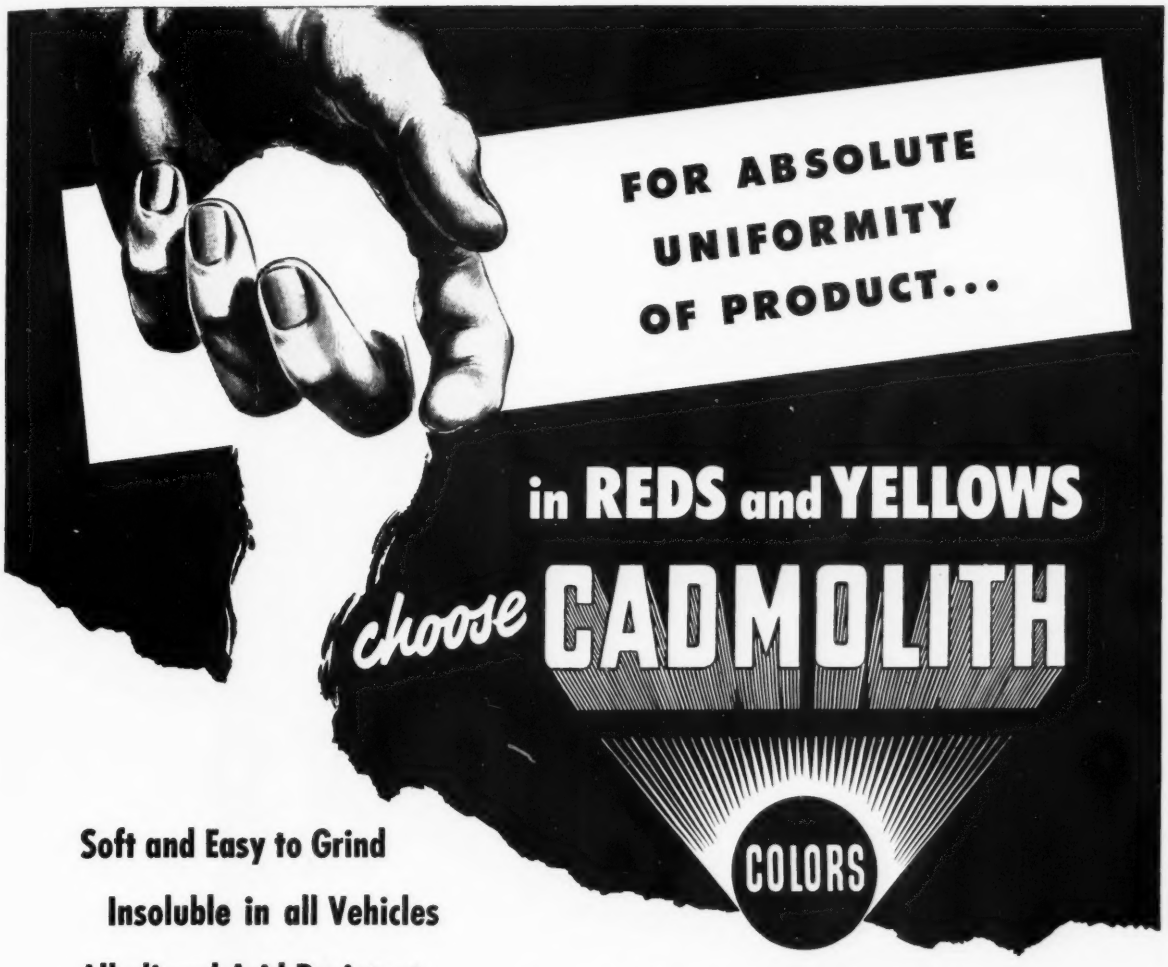

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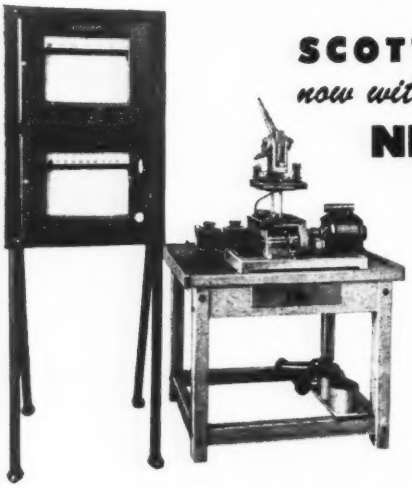

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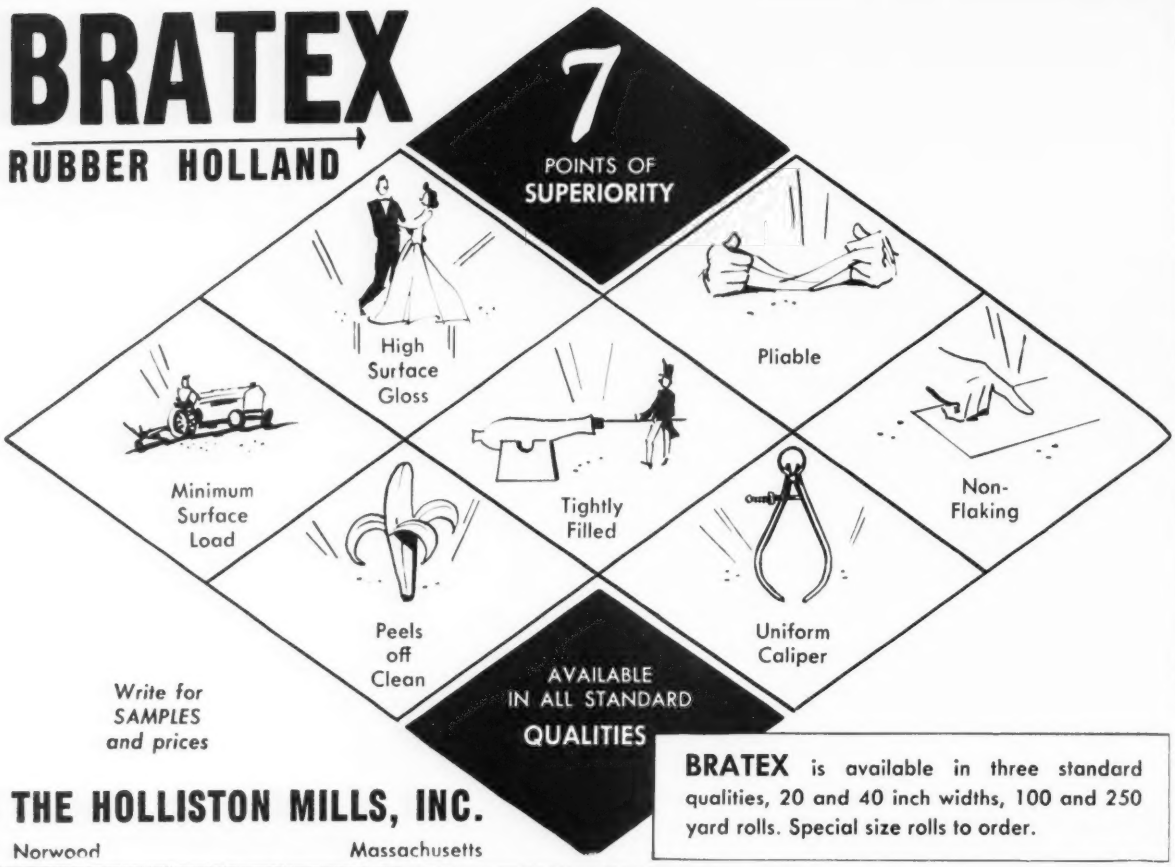

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MBTS	1.5	Stearic acid	1.5
TMTDS	0.5	Pigment (30 vol.)	58.5
Sulfur	2		

Test Results

Mins. Cure at 310°F.	Modulus 100%	Modulus 300%	Tensile	Elongation	Hard. 0"	Hard. 30"	Tear
			Regular Hi-Sil				
15	385	1775	2455	390	63	55	165
30	360	1785	2585	405	63	55	155
45	395	1775	2355	380	63	55	170
60	370	1775	2375	380	63	55	175
120	390	1795	2520	405	65	57	180
			Hi-Sil "C"				
15	300	1530	3750	505	64	56	275
30	320	1595	3820	500	65	57	260
45	320	1660	3680	480	65	58	290
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120	335	1775	4000	495	66	58	275

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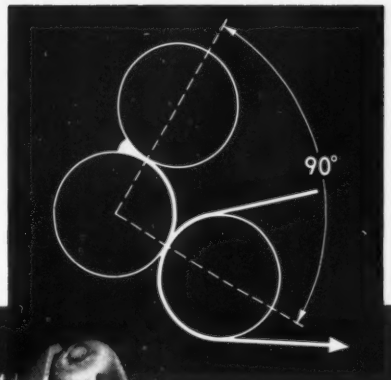

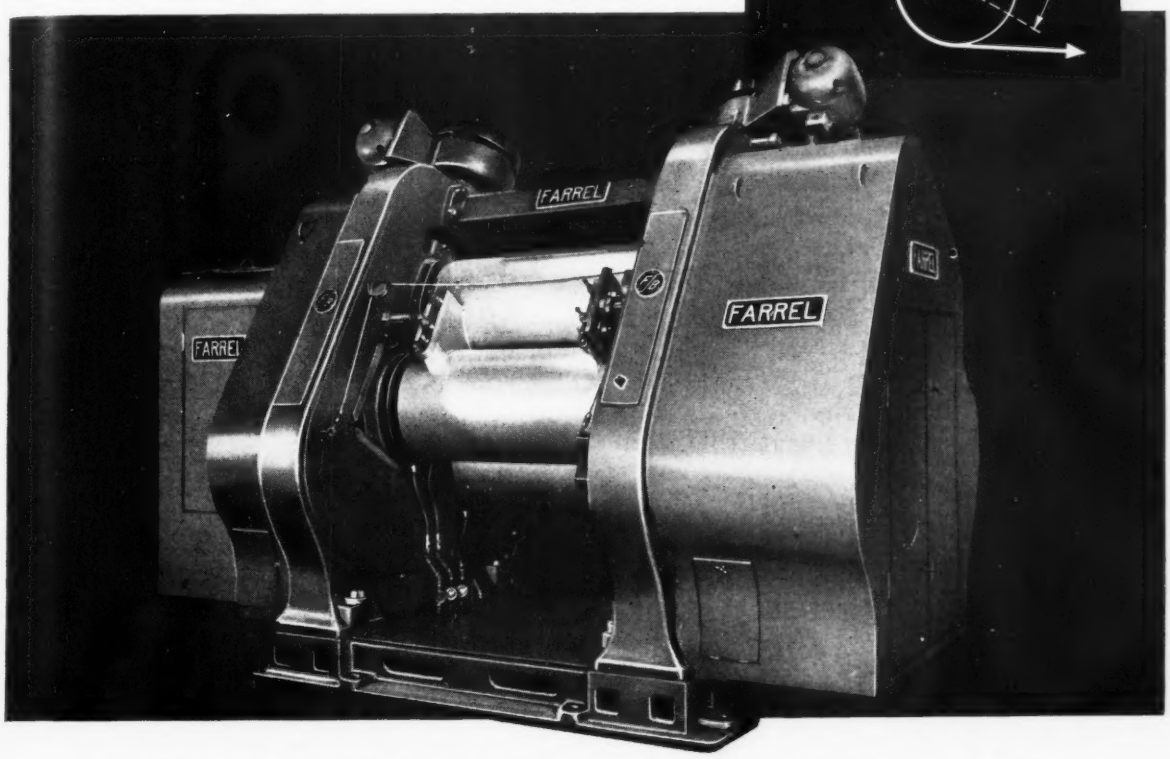

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This new, three-roll, *Tri-angular* calender provides closer control of gauge and easier feeding conditions.

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The angle of the rolls makes feeding easier by providing better support to the feed bank. Both the bank and the guides are easily accessible from floor level.

Although the standard calender has mechanical lubrication, a flood-lubrication system can be specified for high-temperature operation. Other optional features include rolls drilled longitudinally for close temperature control, a motorized crossed-axes device for fine adjustment of roll "crown" on the gauging pass, and the Farrel Uni-drive.

Available in a choice of sizes, the Farrel-Birmingham *Tri-angular* calender is the machine of the future — for any type of production requiring two calendering passes. Write for further information.

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* The *Tri-angular* calender, like the "Z" calender, is an original Farrel-Birmingham development.

Although its angular roll arrangement and some other features are new to three-roll design, they are by no means experimental. All have been used successfully in the Farrel-Birmingham "Z" calender, which has proved to be the outstanding development in calenders in recent years.

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Practical Compounding for Economy[1]

V. H. Vodra[2] and L. A. Jarvis[2]

WITH the fluctuations in the price of natural rubber that have been experienced during the last several months and the relaxation of government regulations restricting its use in rubber products, compounders have the problem of trying to determine at what price it is economical to change from natural rubber to GR-S or *vice versa*. Most generally the change will not be a complete one, but will only be a partial substitution of one elastomer for another. Just as there are many types and grades of natural rubber to be replaced, there are many types and grades of synthetic rubbers to replace them. There are the fatty acid, rosin acid and mixed acid, standard and low temperature, straight chained, cross-linked, and oil-enriched types of GR-S from which the compounder may choose. Reclaimed rubbers also may be substituted for part or all of the natural or GR-S rubbers. Finally, these rubbers may be extended by fillers, resins, and softeners to vary compound cost. The limitation on quantities of fillers used is a function of the proportion of natural and GR-S rubbers used to provide the rubber hydrocarbon. From a consideration of all these possible variations, it is obvious that it is impossible to state a given price relation between natural and synthetic rubbers at which point it would be economical to change *all* formulae from one elastomer to another.

The purpose of this study is to illustrate how compound formulae with varying compositions may be developed to meet given specifications. From these formulae it is possible to determine the prices of natural and synthetic rubbers at which the change from one type formula to another should be made.

TABLE 1. BASE FORMULA—CONSTANT LOADING

Rubber hydrocarbon	100.00
Zinc oxide	3.00
Stearic acid	2.00
Antioxidant	1.00
Purecal SC	100.00
Purecal M	25.00
Hard clay	50.00
Medium process oil	10.00
Sulfur	2.75
Benzothiazyl disulfide	1.00
	294.75

To study the effects of substituting one polymer for another, a base stock was carefully chosen. See Table 1. Since the "pure gum" properties of natural and GR-S rubbers are quite different, loadings were selected which would give about the same results in the two elastomers. Because the stocks might be used in mechanical goods, and "tack" would be important in operations involved in the manufacture of hose, belting, and other products, it had to be present in all stocks. Of course, this "tack" can be eliminated where it is undesirable.

To obtain true "tack" and not just chewing gum stickiness in all GR-S stocks, it is necessary to use an ultra-fine calcium carbonate. Care must be taken not to ruin this tack by the incorporation of too high a quantity of fillers such as carbon blacks, silicas, silicates, clays, whitings, and most of the less common powders. The tolerance of an ultra-fine carbonate filled stock for these other fillers and the ability of the stock to remain tacky depend upon the GR-S used, the quantities of ultra-fine carbonate and softeners present, and the filler to be added.

Purecal SC, an ultra-fine calcium carbonate, was selected to extend the natural rubber and to impart high quality to GR-S stocks. This material gives high tensile strength, high elongation, good tear resistance and flex life, coupled with low modulus and hardness, thus permitting high loadings and low costs. Hard clay was used because of its low cost and good quality. Purecal M was added to improve processing, where desired.

Before proceeding to Table 2, which shows the variations in the kinds of rubber used at constant loading, we would like to discuss briefly Purecal SC, Wyandotte's new coated ultra-fine calcium carbonate which is now making its first appearance on the market. Purecal SC is an ultra-fine carbonate giving essentially the same properties found with Purecals T and U, *but which can be dispersed without special handling*. Because of its better dispersibility, improved quality is obtained at a lower cost, particularly in those cases where ease of dispersion is of major importance. This point is especially true in stocks containing high proportions of natural rubber where masterbatching was formerly essential. Ultra-fine calcium carbonates are more difficult to disperse in natural than in GR-S rubbers. However, even in all-GR-S stocks where the dispersion of Purecals T or U was satisfactory, quality im-

[1]Presented before the Quebec Rubber & Plastics Group, Montreal, P. Q., Canada, Oct. 16, 1952, and Kitchener Rubber Group, Kitchener, Ont., Canada, Jan. 6, 1952.

[2]Wyandotte Chemical Co., Wyandotte, Mich.

provements are found in the factory with the substitution of Purecal SC.

TABLE 2. RUBBER VARIATIONS—CONSTANT LOADING

#1 Thin light-brown crepe	100-0	75-25	25
GR-S 1001 (X-631)	0-100	25	75-25
1500 (100)	0-100	.....	.....
Polygen Krynol* (oil-enriched GR-S)	0-100	.....	.....
Whole tire reclaim	.....	0-100	0-100

*Polymer Corp., Ltd., Sarnia, Ont., Canada.

Typical results from factory runs with commercial all-GR-S compounds containing an ultra-fine carbonate as one of the loading materials showed, when the change to purecal SC was made: (1) a 16% increase in tensile strength in a tire carcass stock; (2) a 26% increase in abrasion resistance in canvas soling; (3) a 132% increase in flex life in a belt carcass stock; (4) an 88% increase in tear resistance in a hose carcass stock; (5) a 28% increase in extrusion speed in a CV wire covering stock.

The 2% coating on Purecal SC is formulated to maintain the same curing rate found with Purecals T and U. To our knowledge, this is the first time a coating has been used on a commercial calcium carbonate which does not retard cure, lower the modulus, and reduce the resilience of the stocks in which it is used. Advantage can be taken of this fact to increase cure rate or lower accelerator requirements when Purecal SC is substituted for other precipitated calcium carbonates and whitings.

Stocks are "lively" and "rubbery" when Purecal SC is the only loading material. Tire carcass stocks have good rebound when Purecal SC is used in place of Purecal T, even though the latter material provides stocks with a good degree of resilience.

The coating does not impair the excellent aging properties of stocks made with the ultra-fine Purecals; nor does it impair the color. The same savings in titanium dioxide can be realized with Purecal SC as with the other Purecals, when substituted for cheaper, less bright carbonates and clays.

Purecal SC was primarily developed to overcome the processing difficulties attending the use of an uncoated ultra-fine calcium carbonate. In the following study, Purecal SC makes every stock commercially practical, using only standard factory practices.

Purecal M is a fine particle size uncoated calcium carbonate frequently used because of its very great ability to improve processing. It reduces equipment tack without seriously harming building tack. Production rates from calenders and more particularly extrusion rates are increased markedly when this material is used instead of most other fillers. A fine surface finish is another reason for the use of Purecal M in some of the compound formulae to follow.

Effect of Natural-GR-S Interchange

As mentioned previously, Table 2 shows the variations in rubber by types at constant loading as used in this study. The first compounds were made with #1 thin light-brown crepe type of natural rubber, and this was gradually replaced by Standard GR-S (1001) until no natural rubber was left in the compound. Low temperature GR-S 1500 (cold rubber) and 45% oil-enriched Polygen Krynol were next used to replace natural rubber in the base formula.

Whole tire reclaim was also substituted for the natural rubber portion in a 75-25 mixture of natural and GR-S rubbers until 50% of the total elastomer content was reclaimed rubber. Similarly, whole tire reclaim was substituted for the GR-S portion in a 75-25 GR-S-natural rubber mixture. No accelerator adjustments were made to compensate for the retardation in cure as the GR-S portion was increased. Instead, curing times were increased until the modulus curve had flattened, and optimum cures were obtained.

Figures 1 and 2 show the effects on tensile strength, modulus, elongation, and tear resistance as the natural rubber is replaced by standard GR-S. With the exception of the elongation, the remaining properties seem to decrease as the GR-S increases.

Figure 3 shows the effect on tensile strength as the natural rubber portion is replaced by LTP and oil-enriched GR-S rubbers. The variation in properties for other physical tests is about the same degree as that for tensile strength; so for simplicity only tensile strength values are shown. LTP GR-S produced better results than standard GR-S when used to replace natural rubber; while the oil-enriched rubber gave at least equal results throughout the entire study.

Figure 4 shows the effect on tensile strength as whole tire reclaim is substituted for part of both the natural and GR-S in the base formula. The curve marked "Natural" shows the results obtained when whole tire reclaim was substituted for natural rubber in the 75-25 mixture of natural and GR-S rubbers, and the curve marked "GR-S" indicates the effect of the substitution of whole tire reclaim for GR-S in the 75-25 GR-S-natural rubber mixture. The substitution of whole tire reclaim for either natural or GR-S rubber in these mixtures lowered the tensile strength.

Five Different 1500 PSI. Tensile Strength Compounds

In Table 3 the rubber hydrocarbon portion is kept constant at 75-25 natural rubber-GR-S as the loading is increased from 100 to 250 parts of filler on 100 parts of elastomer. To keep the hardness somewhat in line, the softener is increased from 5 to 15 parts. Figure 5 shows the decrease in tensile strength as the loading was increased.

TABLE 3. BASE FORMULA—VARIABLE LOADING

#1 Thin light-brown crepe	75.00			
GR-S 1001 (X-631)	25.00			
Zinc oxide	3.00			
Stearic acid	2.00			
Antioxidant	1.00			
Sulfur	2.75			
Benzothiazyl disulfide	1.00			
Purecal SC		75.00	100.00	100.00
" M		.....	25.00	75.00
Hard clay		25.00	50.00	75.00
Medium process oil		5.00	10.00	15.00
		214.75	294.75	374.75

From Figures 1, 3, 4, and 5 it is possible to select different stocks, all of which have the same tensile strength, for example, 1500 psi., but with quite different compositions. Figure 6 illustrates the composition of five such stocks. Obviously, many other variations are possible.

In stock A, Figure 6, two-thirds of the rubber hydrocarbon is GR-S, and one-third is natural rubber. The filler loading is 100 pounds.

In stock B the natural rubber comprises two-thirds of the total rubber hydrocarbon, and GR-S one-third. The filler loading is 175 pounds. It is obvious from the data that natural rubber can be loaded more than GR-S and still give a stock with a 1500 psi. tensile strength.

In stock C the natural rubber portion amounts to three-fourths of the total, and the filler loading at 183 pounds is still higher.

In stock D the loading at 170 pounds is nearly equal to that in stock B, but 10 parts of whole tire reclaim were substituted for two parts of natural rubber and three

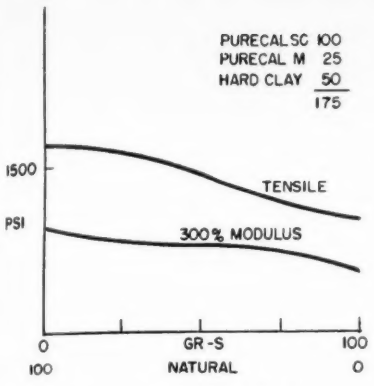


Fig. 1. Natural-GR-S Replacement—Constant Loading (Tensile, Modulus)

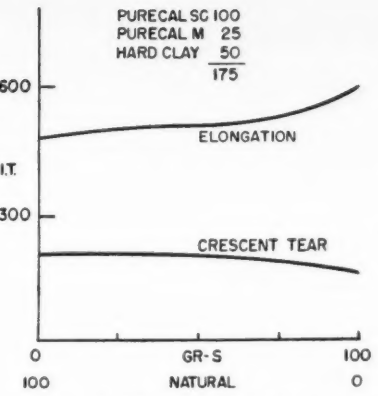


Fig. 2. Natural-GR-S Replacment—Constant Loading (Elongation, Tear)

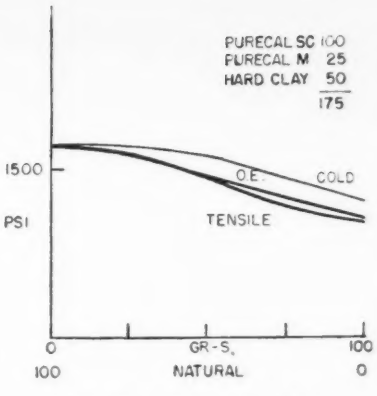
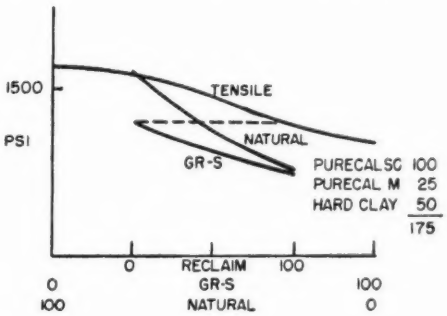


Fig. 3. Cold GR-S-O.E. GR-S Replacement—Constant Loading

Fig. 4. Natural-GR-S Replacement with Reclaim — Constant Loading



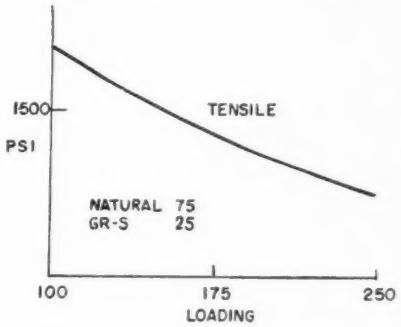


Fig. 5. Increase Loading — Constant Rubber

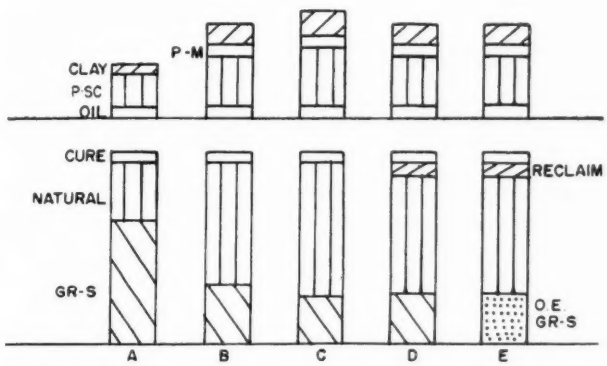


Fig. 6. Formula Comparison—1500 PSI. Tensile

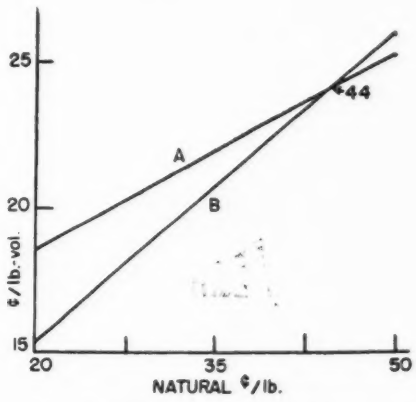


Fig. 7. Cost Comparison with Increasing Rubber Prices

parts of GR-S in the elastomer base. This stock was dark in color, but the small amount of reclaimed rubber might slightly help processing in the factory.

Stock E was the same as stock D except that Polygen Krynol (oil-enriched GR-S) was substituted for the standard GR-S. Stock E will show a price advantage if the Polygen Krynol price is reduced below that of standard GR-S.

Figure 7 shows the variation in cost between stocks A and B, with a range of prices for natural rubber between 20 and 50¢ a pound. Although stock B with a higher proportion of natural rubber is cheaper when natural rubber is 20¢ a pound, as the price of natural rubber increases, the pound volume costs of stocks A and B increase, but at different rates, and above 44¢ a pound for natural rubber, stock A becomes cheaper.

Figure 8 shows the pound volume costs for five selected stocks with natural rubber at 20 and 30¢ a pound, and with all the other material prices remaining constant. With 20¢ natural rubber, each succeeding stock in this series is cheaper than the preceding one. With 30¢ natural rubber, however, stock C is now more expensive than stock B, and the advantage of stock E over stock D is reduced.

It should be pointed out here that with one exception the prices used were for carload quantities of all ingredients as reported in September, 1952. The exception is the price used for the oil-extended GR-S type of polymer. Its price was anticipated at 18¢ a pound, based on the reduction of the 25% oil-enriched GR-S 1700 to 19½¢ a pound. Polygen Krynol, being a 45% oil-enriched GR-S type-rubber, should eventually end up at about 18¢ a pound, based on the same prices for the oils used in GR-S 1700.

Although the five stocks mentioned above had the same tensile strength, their other properties differed. Figure 9 shows the modulus at 300%, ultimate elongation, and

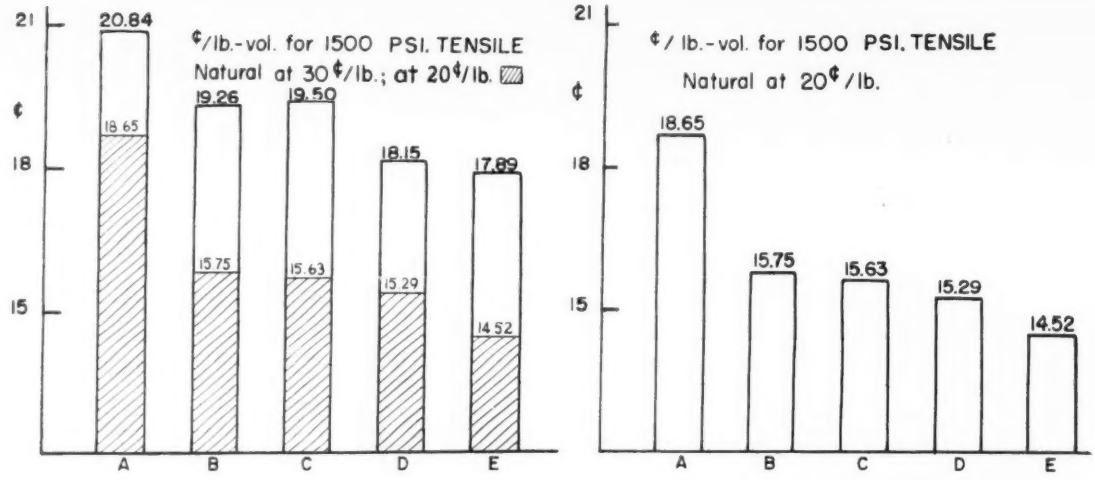


Fig. 8. Costs -c/Lb.-Vol. for 1500 PSI. Tensile—Natural at 30 and 20c a Pound

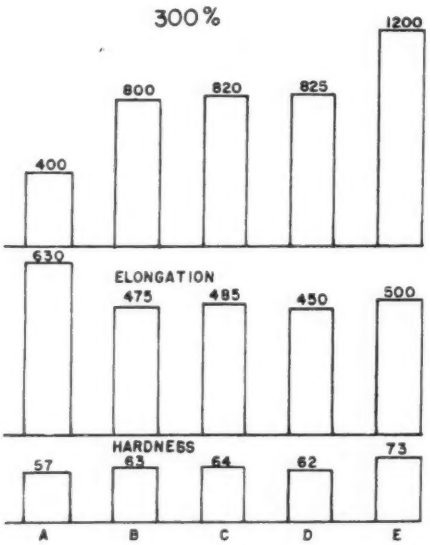


Fig. 9. Modulus at 300%, Elongation, Shore Hardness for the 1500 PSI. Tensile Stocks

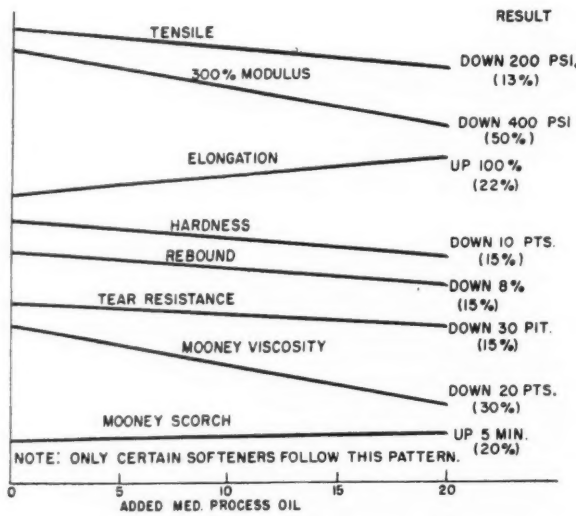


Fig. 10. What Happens When Softener Is Added to a 1500 PSI. Tensile, 65 Shore Hardness Stock

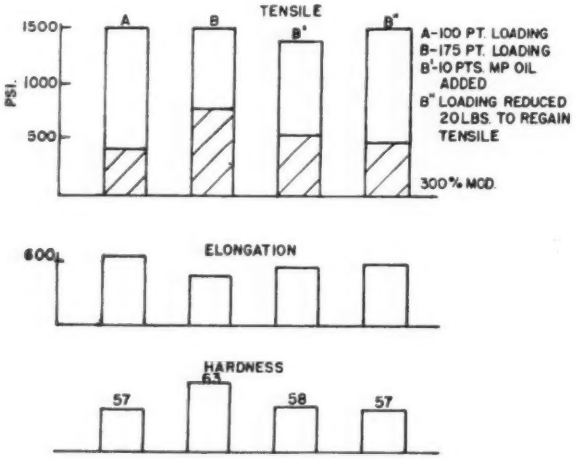


Fig. 11. Comparison before and after Adjustment for Hardness and Tensile

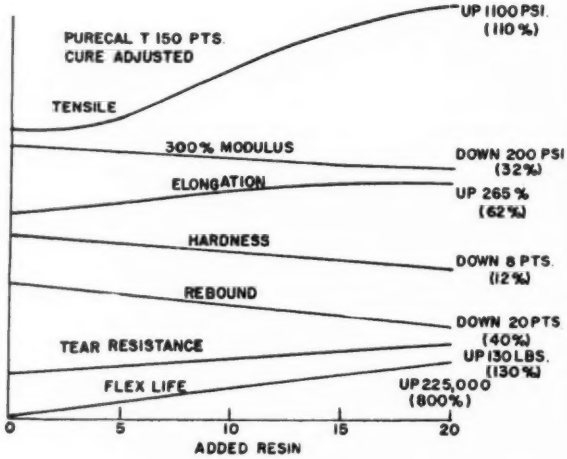


Fig. 12. What Happens When a Reinforcing Resin Is Added to an All-GR-S Stock

Shore A hardness for the stocks of equal tensile strength. Stocks B, C, and D had about twice the modulus and were about six points harder than stock A. Stock E had three times the modulus and was 16 points harder than stock A. Also, stock A had the greatest elongation of all the stocks. If in addition to tensile strength, therefore, modulus, elongation, and hardness were factors in connection with the use of any of these stocks, adjustments would have to be made in stocks B through E before they could be substituted for stock A.

Effect of Softener on 1500 PSI. Tensile Strength Stocks

The effect on a 1500 psi. tensile strength, 65 Shore hardness stock of the addition of a softener such as a medium process oil is shown in Figure 10. The medium processing oils which have been found best for this purpose are Circosol 2XH,[3] Dutrex 20,[4] Shell SPX-97,[4] Sundex 53,[3] Bardo,[5] Nuso 250,[6] and Paraflux.[7] The light process oils, usually so satisfactory with natural and neoprene rubbers, cause too rapid deterioration of the properties of high GR-S stocks, when substituted for medium process oils.

Up to a 20-part addition, the effects of the medium processing oil softener are almost in direct proportion to the quantity added. Thus, when a compound within the 20-part range is being adjusted, approximately the following effects on physical properties may be expected. For each pound of softener added: (1) The Shore A hardness will decrease 0.5-point. (2) The tensile strength will decrease 10 psi. (3) The 300% modulus will decrease 20 psi. (4) The tear resistance (crescent) will decrease 1.5 pounds per inch thickness. (5) The resilience (Lupke rebound) will decrease 0.4 of a point. (6) The Mooney viscosity (ML/4/212° F.) will decrease one point. (7) The Mooney scorch (MS/250° F.) will increase 0.25 of a minute. (8) The ultimate elongation will increase 5%.

Beyond the range of 20-part softener addition, adjustments for retardation of rate of cure and changes in factory processing might be required.

Figure 11 shows how stock B in Figure 6 might be adjusted by the addition of softener and adjustment of loading to have properties other than tensile strength similar to stock A in Figure 6. Stock A originally had 100 parts of filler and five parts of oil added to the rubber hydrocarbon; while stock B had a filler loading of 175 parts. The addition of 10 parts of medium processing oil to stock B, resulting in stock B′ in Figure 11, adjusted the hardness and made the elongation more nearly like that of stock A, but at the expense of the tensile strength. Stock B″ with 155 parts of filler loading returned the tensile strength to 1500 psi., the hardness remained about the same, and the elongation was now very close to that of stock A.

Obviously, stock B″ should be much cheaper than stock A, unless the price of natural rubber is exceedingly high. Stock B″ would also mix faster and process more smoothly than stock A, thus resulting in lower finished stock cost.

Effect of Reinforcing Resin

To this point no modifications have been made in the base formula as the GR-S portion is increased, in order to improve the properties of the resultant compounds. Non-black stocks, or stocks containing small amounts of carbon black, can often be greatly improved by the incorporation of a reinforcing resin. An example of what happens when a reinforcing resin is added to a non-black, all-GR-S stock is shown in Figure 12. These resins are usually of the coumarone-indene type and have melting points in the range of 100-130° C. Reinforcing resins that have been found to be completely satisfactory include Cumar MH,[5] Neville R 16,[8] Neville R 16A,[8] Picco 100,[9] Picco 420,[9] Picco 450,[9] and Panarez 3-210.[10] Undoubtedly there are other reinforcing resins on the market that do an equally good job, but it is our recommendation that they be checked against one of the above to be certain that they are completely satisfactory before use.

The effect of adding the reinforcing resin to the stocks containing GR-S is not linear for all physical properties. The improvement in tensile strength and elongation with standard GR-S is most noticeable after the addition of between 10 and 15 parts of resin; while more than 20 parts has little additional reinforcing effect. Thus, for practical purposes, where increased hysteresis and decreased resilience can be tolerated, the addition of 15 to 20 parts of resin per 100 parts of standard and oil-enriched GR-S is recommended. With LTP GR-S, about half this amount is recommended for two reasons: (1) Cold rubber tends to be more sticky than standard GR-S, and, if 20 parts of resins are added, the resultant stock may be difficult to process. (2) Cold rubber is not benefited to the same extent as standard GR-S, and lesser amounts of resin seem sufficient.

Before leaving Figure 12, particular attention is called to the very beneficial effects these reinforcing resins have on such properties as tensile strength, elongation, tear resistance, and flex life. They lower modulus and hardness, thereby permitting higher filler loadings while remaining in the "practical" range for such loadings. Resin reinforced stocks are smoother, better processing, faster extruding and calendering, cheaper, and may have better overall quality than stocks not containing these resins.

Increasing the GR-S content of a given stock retards the cure, and the addition of reinforcing resins slows down the cure even further. For practical purposes, therefore, the GR-S portion was accelerated with 1.5 parts of a thiazole accelerator and 0.2-part of an ultra-accelerator; while the natural rubber portion was accelerated with one part of thiazole only. The substitution of reclaimed rubber for either the natural or GR-S rubber seemed to have no effect on the rate of cure of the stocks used in this study.

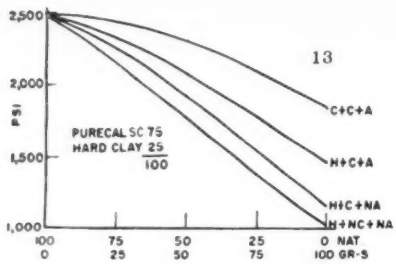
Effect of Aging

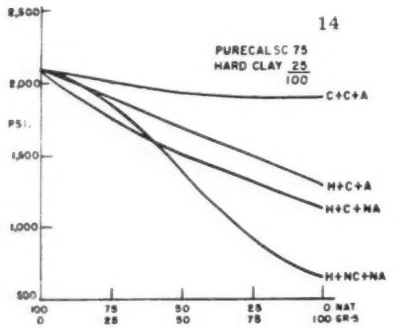
The effect of aging 24 hours in air at 212° F. on stocks composed of blends of natural and GR-S rubbers compounded with 75 parts of Purecal SC and 25 parts of hard clay are shown in Figures 13-17. Figure 17 is a summary of Figures 13, 14, 15, and 16.

In Figure 13 the lower curve shows the tensile strength resulting from the direct substitution of standard GR-S for natural rubber without any attempt being made to maintain tensile strength by the addition of reinforcing resin or additional accelerator. The coding of this curve, H+XC+NA, denotes hot or standard GR-S + no coumarone-indene resin + no accelerator addition. The curve directly above, H+C+NA, denotes hot GR-S + coumarone-indene resin + no additional accelerator. The next curve, H+C+A, shows the results for a compound made with hot GR-S + coumarone-indene resins + additional accelerator. The top curve, C+C+A, is for a stock made with cold rubber + coumarone-indene resin

[3] Sun Oil Co.
[4] Shell Oil Co.
[5] Barrett Division, Allied Chemical & Dye Corp.
[6] Standard Oil of N. J.
[7] C. P. Hall Co.
[8] Neville Co.
[9] Pennsylvania Industrial Chemical Co.
[10] Pan American Oil Co.

Fig. 13. Constant Loading — Unaged Tensiles





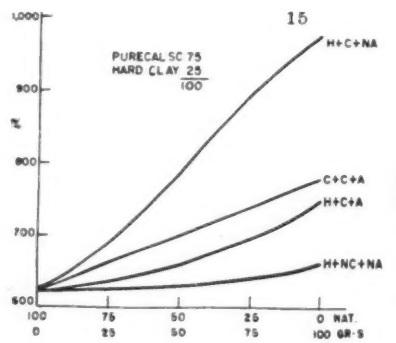
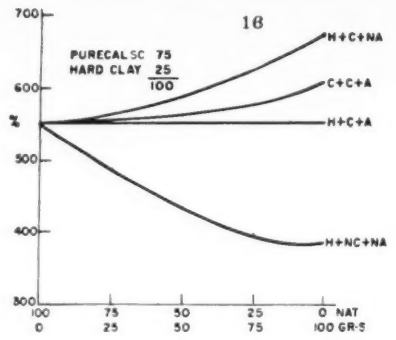
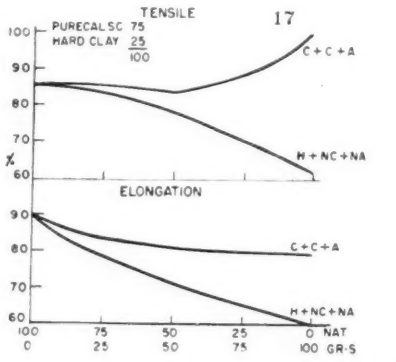


Fig. 14. Constant Loading — Tensiles after Aging 24 Hours at 212° F. in Air

Fig. 15 Constant Loading—Unaged Elongation

Fig. 16. Constant Loading—Elongation after Aging 24 Hours at 212° F. in Air





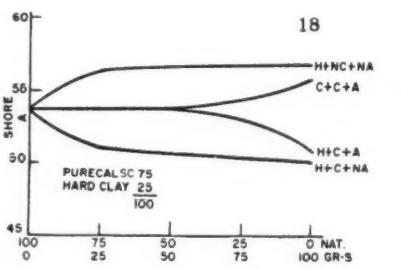
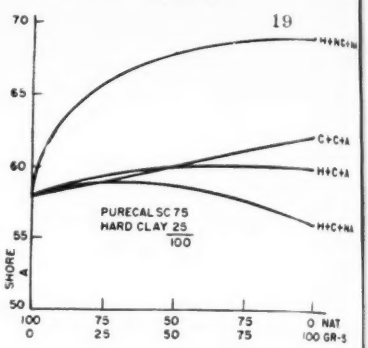
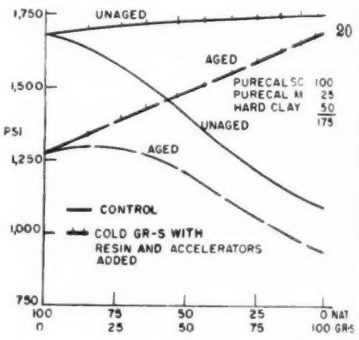


Fig. 17. Constant Loading — Percentage Retained after Aging (Tensile and Elongation)

Fig. 18. Constant Loading — Hardness (Unaged)

Fig. 19. Constant Loading — Hardness after Aging 24 Hours at 212° F. in Air





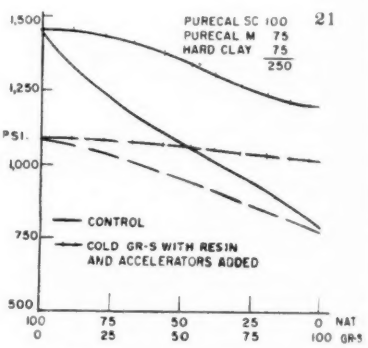


Fig. 20. Constant Loading — Unaged and Aged Tensiles

Fig. 21. Constant Loading—Tensiles. (Control vs. Cold GR-S with Resin and Accelerators Added)

+ accelerator addition. This same coding is used for Figures 14-16. Figure 13 presents data for compounds before aging; Figure 14 for tensile strength after aging; Figure 15 for elongation before aging; and Figure 16 for elongation after aging.

It is obvious that as changes are made in the composition of the compounds from 100% natural rubber to 100% GR-S, the quality of the compounds, as measured by tensile strength and elongation, decreases. As indicated in Figures 13 through 17, however, the use of reinforcing resin and additional accelerator, particularly with LTP GR-S, minimizes the degree of this decrease in quality.

Many specifications for rubber products require that the decrease in tensile strength and elongation after aging shall not exceed a certain figure. With resin-accelerator adjustment it may be possible to substitute across the entire range from 100% natural rubber to 100% GR-S and still meet the specifications. Without these adjustments a high proportion of natural rubber might always be required.

For example, in Figure 17, if 75% of the original tensile strength were required after aging, substituting GR-S for natural rubber would have to stop at about 55% replacement, if no adjustment with resin and additional accelerator was made. If the 75% limitation were placed on elongation, only about 35% of the natural rubber could be replaced. Yet after adjustment with resin and additional accelerator, the 100% LTP GR-S stock would be satisfactory and could be used if the price of natural rubber became too high.

Figures 18 and 19 show the effects of resin-accelerator

TABLE 4. FORMULAE FOR 1500 PSI. TENSILE AND APPROXIMATELY 65 SHORE A HARDNESS

	A	B	C	D	E	F	G
300% Modulus (psi.)	1000	840	840	375	200	675	640
Elongation (%)	450	490	490	700	700	500	500
#1 Thin light-brown crepe	100	50	50	...	...	50	50
GR-S 1500 (100)	...	50	...	100	...	25	...
Polygen Krynol (oil-enriched GR-S)	...	...	50	...	100	...	25
Whole tire reclaim	...	...	...	...	...	50	50
Zinc oxide	3	3	3	3	3	3	3
Stearic acid	2	2	2	2	2	2	2
Antioxidant	1	1	1	1	1	1	1
Sulfur	2.75	2.75	2.75	2.75	2.75	2.75	2.75
Benzothiazyl disulfide	1	1.25	1.25	1.5	1.5	1.125	1.125
TMTDS	...	0.1	0.1	0.2	0.2	0.05	0.05
Purecal SC	100	100	100	100	80	75	75
M	50	50	25	50	25	10	...
Hard clay	70	60	50	50	50	35	35
Softener	18	12	10	13	3	3	3
Reinforcing resin	...	10	10	20	20	5	5
	347.75	342.10	305.10	343.45	288.45	262.925	252.925
Specific gravity	1.60	1.59	1.53	1.56	1.50	1.45	1.42

NOTE: Stock D will be too sticky for easy processing unless softener-reinforcing resin combination is adjusted and includes ample detackifiers.

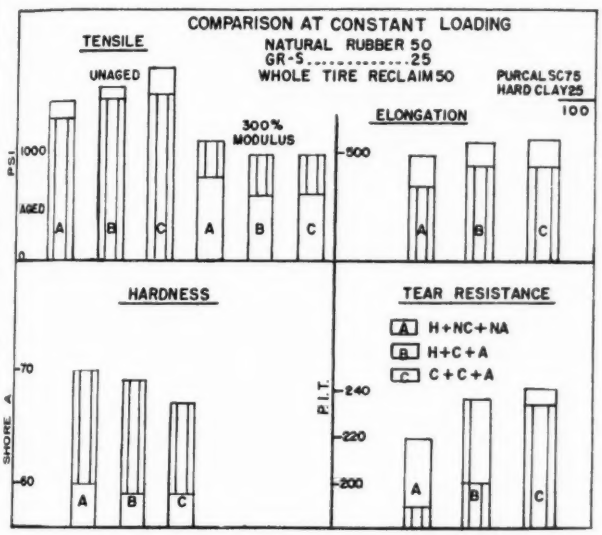


Fig. 22. Comparison at Constant Loading

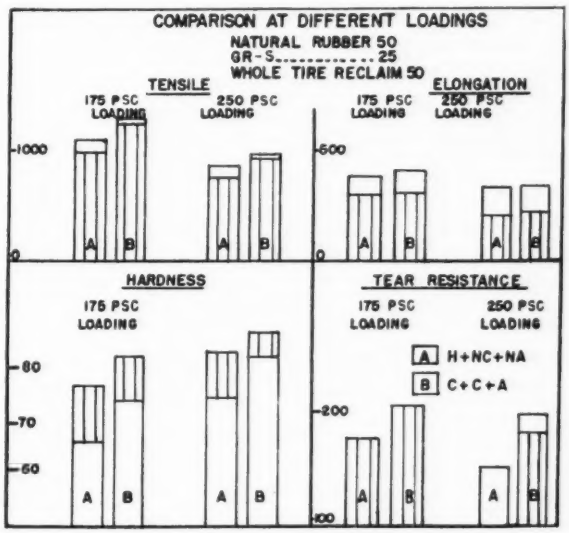


Fig. 23. Comparison at Different Loadings

adjustment on hardness, both before and after aging 24 hours in air at 212° F. Again changes are minimized, and results after aging improved.

The improvements obtained with reinforcing resins and additional accelerator, as shown in Figures 13 through 19 for stocks with loadings of 100 parts, also hold when the loadings are increased to 175 and 250 parts, as may be seen in Figures 20 and 21. These latter loadings represent a rubber hydrocarbon range from 42.5 to 71% by volume and 24.5 to 46.5% by weight.

Stocks containing whole tire reclaim also are benefited by the reinforcing resin and additional accelerator, whether the loading is 100, 175, or 250 parts. See Figures 22 and 23. Although only 25% of the rubber hydrocarbon is GR-S in this series, the adjustment with resin and additional accelerator produces significant results. With increasing amounts of GR-S, the effects of the resin-accelerator adjustment would become even more apparent.

Summary and Conclusions

Now we come to the crux of the whole study. By selecting different combinations of rubber hydrocarbons and making suitable adjustments for reinforcing and accelerating the GR-S portion, we obtained the new series of loading curves shown in Figure 24. From these curves it is possible again to determine how much loading each

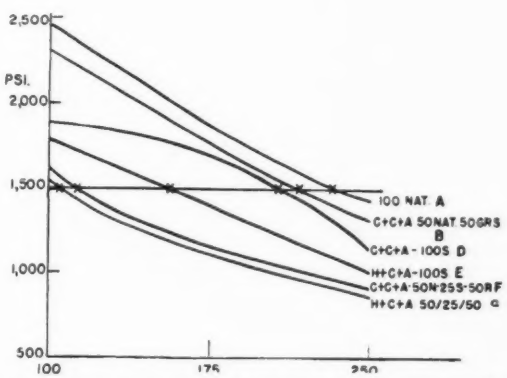


Fig. 24. Varying Loadings with Various Rubber Systems—Tensile strength

system may contain and still give a tensile strength of 1500 psi. Adjustments similar to those made for the compounds presented in Figure 11 were then made to give comparable compounds of approximately 65 Shore A hardness. The formulae for these compounds are given in Table 4. Results for the modulus at 300% and ultimate elongation for each stock are given with each formula, and the composition is illustrated graphically in Figure 25.

(*Continued on page 650*)

Biosynthesis of Guayule Rubber

ALTHOUGH systematic research work on natural rubber has been carried out for many years, and the chemical composition and even the synthesis of rubber were studied at a very early period in the history of the material, there seems to be no indication in the literature of experimental investigation of the synthesis of rubber in the plant, until quite recently. Yet a knowledge of the precursors and other substances involved in the formation of rubber in the plant itself might be expected to provide the means for producing a natural rubber synthetically outside the plant organism.

It was not until 1946 that a program of research into the biosynthesis of rubber was started at the California Institute of Technology as a cooperative project now with the Office of Naval Research and then again with the United States Department of Agriculture, Bureau of Plant Industry, Soils & Agricultural Engineering, Division of Rubber Plant Investigations. In the Kerckhoff Biological Laboratories of the California institution, B. Arreguin, J. Bonner, B. J. Wood, and others in the research group, confining themselves exclusively to guayule, began a series of investigations which are still going on and which have already yielded intriguing results. That positive results could be obtained was made possible by a peculiarity of the guayule plant which was revealed when cultures of stem tissue were studied. It was found that under the right conditions bits of stem tissue grow vigorously in culture, but that rubber is not formed unless extract of the leaves of guayule plants actively producing rubber is added to the nutrient medium. In other words, the substance necessary for the synthesis of rubber in the guayule plant is contained in the leaves; whereas the actual rubber is formed in the stem, a fact confirmed by experiments conducted also on seedlings and mature plants grown under greenhouse conditions.

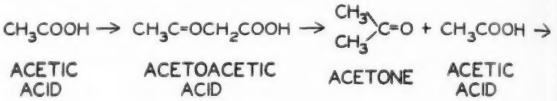
The next step was to attempt to identify the rubber precursor.

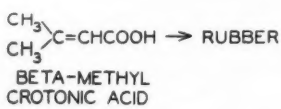
Now, while prior to 1946 no experimental work had been done on the biosynthesis of rubber in the plant, the literature offers suggestions as to the possible courses which such synthesis might take. Since isoprene has never been found in plant tissue, it is excluded as a possible precursor. On the other hand, some five-carbon branched chain other than isoprene itself might very well be the elementary unit which is polymerized to form rubber. Starting from this premise, the investigators at California Technical Institute tested a number of likely substances, without success. But eventually they discovered a reaction which had not hitherto been suggested in the literature, but which proved definitely important for rubber formation. This reaction follows:

Acetone + Acetic Acid → Beta-Methyl Crotonic Acid.

When acetic acid and acetone were added to the nutrient solution in which tissues or seedlings were growing, a considerable increase in the formation of rubber followed, ranging from 25% to three times the original amount, depending on conditions. Similar results were obtained when beta-methyl crotonic acid was added. Experiments with isotopic carbon showed clearly that the addition of these compounds did indeed support rubber formation in guayule, and, furthermore, that beta-methyl crotonic acid is formed during the metabolism of acetate by guayule though attempts to isolate it from the plant proved unsuccessful.

The foregoing results suggest that acetoacetic acid is an intermediate in rubber synthesis, and that this may be metabolized to beta-methyl crotonic acid as a further intermediate in the process as illustrated below:





These results also suggest that there is a far-reaching analogy between the synthesis of fatty acid in microorganisms and in higher animals, and rubber formation. In the former case two acetic acid molecules condense; then the product is reduced, and the resulting four-carbon compound condenses with further acetate molecules to form the long chain fatty acids. In the case of rubber it is thought a similar process may take place with, however, beta-methyl crotonic acid as the fundamental repeating unit.

Later work has shown that rubber is only one of various products formed from acetic acid in the guayule plant, and that this pathway is of less importance than the metabolism of acetic acid to resins; it is added that the latter pathway may involve the same isoprenoid precursor as that involved in rubber synthesis. But most of the acetic acid added to guayule tissue—half and more than half—is metabolized to amino acids, particularly the branched-chain amino acids, leucine and valine, and the dicarboxylic amino acids, aspartate and glutamate.

The work carried out so far in California thus shows that acetic acid may serve as a substrate for rubber production, but further experimentation is necessary to determine the exact way in which conversion of acetic acid to rubber takes place.

To the onlooker, even at this stage, the results of the investigations suggest new and far-reaching possibilities, not only in the field of rubber and elastomer synthesis, but perhaps also for rubber growing. It might turn out that an understanding of the way rubber and resins are formed in plants could point the way to improvement in the quality not only of guayule rubber, but of other rubber-bearing plants in which the value of the rubber is lowered by high resin content. The investigations might reveal a new method of increasing rubber yields of these plants and of *Hevea* too; might provide a means for combating the effects of South American leaf disease and *oidium;* might even be instrumental in largely eliminating these diseases. Workers in the East and in the West have found individual disease-resistant trees which, however, often have the drawback of being low yielders, and their good qualities can only be made use of by budding them on to high-yielding trees; often it is necessary to bud both for disease resistance and

(*Continued on page* 712)

Latest Developments in Synthetic Elastomers[1]

Harry L. Fisher[2]

Harris & Ewing

Harry L. Fisher

IT IS desirable at first to specify the time limit for the latest developments. Every item mentioned has been published, and practically all of you have read them; yet you probably have not kept them all active and correlated in your memories. It is reminiscent of the reports from the Congress; you read them, but a little later you are not sure whether or not a certain bill has been passed. That is why I have been asked to bring together items of interest that have been done chiefly during the past year and how all these things fit together. A considerable choice has had to be made because the number of papers is great. Comments will be brief. The articles are almost entirely American.

The government removed practically all rubber restrictions last summer, and now there is direct competition between natural rubber and synthetic rubber. The Rubber Act was extended from June 30, 1952, to March 31, 1954, and proposals for evaluating and later selling the plants are already being worked up for future use.

GR-S is manufactured both hot at 122° F. and cold at 41° F. and is by far the largest synthetic rubber in production. About 55% of the total now being made is cold rubber. The major differences in polymer structure of cold GR-S, as compared with regular GR-S, have been stated to be a narrower molecular weight distribution with less of the soft low molecular weight polymer, a slight increase in tendency to crystallize, and an increase in homogeneity of the polymeric composition (1).[3] Cold GR-S has better extrusion characteristics and, when properly compounded, has higher tread-wear resistance even than natural rubber. A shortstopping problem has shown the practical use of sodium dimethyldithiocarbamate and sodium polysulfide (2). It is recalled that cold GR-S has about 76% of trans-1,4 addition of the butadiene residue, 3% of cis-1,4 addition, and 21% of 1,2-addition (3). Lower temperatures of polymerization do not change this proportion appreciably, but higher temperatures bring the trans- and cis-1,4 addition much closer together and scarcely change the proportion of 1,2-addition. These results have been obtained by infrared absorption and by oxidation with ozone and with permanganate.

Ozonolysis has given direct information on how the monomers are joined together, although it has been shown that the 1,2,3-propane tricarboxylic acid obtained from several different polymers apparently depends on the type of cleavage (4). This acid was obtained by treatment of the ozonide with hydrogen peroxide, and the final products were separated chromatographically. 1,2,4-Butane tricarboxylic acid and succinic acids are the usual products from polybutadiene, and in addition there are acids containing phenyl radicals from GR-S which contains styrene residues. Acidified permanganate on polybutadienes gave chiefly succinic acid, β-carboxyadipic acid, $HOOCCH_2CH(COOH)CH_2CH_2COOH$, and 1,2,3-propane tricarboxylic or tricarballylic acid, $CH_2(COOH)CH(COOH)CH_2(COOH)$. (5)

The Cold GR-S Problem

Although the present cold GR-S gives excellent tread resistance to abrasion, it is not so good for a carcass stock as natural rubber because, upon being stretched, it produces more heat than natural rubber, that is, its hysteresis is too high, it has poorer tensile strength at 212° F. than natural rubber, and it has too much of the low molecular weight portion of the total copolymer. Very good results have been obtained with one of these properties in separate rubbers, but what is needed is to have them all in proper balance with other required properties in one preparation. High tensile strength in pure gum stocks would also be advantageous. More complete conversion would be helpful in removing the low molecular weight portion and also in eliminating the stripping operation to recover unconverted butadiene and styrene. The use of other monomers may solve the hysteresis problem since incorporation of isoprene, 2,3-dimethyl butadiene, and especially 2,3-dialkyl butadienes in which the two alkyl groups are of different lengths, have given copolymers with interesting properties. Work in these directions ought to produce excellent results.

Oil-Extended and Plasticized GR-S

Oil-extended high-viscosity GR-S type of synthetic rubber has proved its worth and produced processible stocks which, when properly compounded, give the same general resistance to abrasion as, and sometimes a little higher than, cold GR-S in passenger tires (6). The oils are only about 2¢ a pound; therefore this incorporation into synthetic rubber is economically attractive. The type of oil makes a difference, and the oil companies are producing special products for testing (7). Naturally the addition of 25 to 100 parts of oil per 100 parts of synthetic rubber brings about problems in processing, compounding, splicing, and final products, but these are being studied and are being solved. The oil can be incorporated on a mill or in a Banbury, but better by addition to latex and coagulated as a masterbatch. Aging of the oil-enriched copolymers is as good as or better than standard GR-S compounds. Oil-extended synthetic rubbers may be of service in carcass compounds.

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[1] Presented before The New York Rubber Group, New York, N. Y., Oct. 24, 1952.

[2] Formerly with Office of Synthetic Rubber, Reconstruction Finance Corp., Washington, D. C. Present address: Professor of rubber technology, School of Engineering, University of Southern California, Los Angeles, Calif. Dr. Fisher is also president-elect of the American Chemical Society.

[3] Numbers in parentheses refer to Bibliography items at end of this article.

Nitrazole Copolymer

Another interesting development is a GR-S type of copolymer containing a ratio of 70 to 30 parts of butadiene and styrene prepared with a stabilized salt of diazotized p-nitroaniline (Nitrazole CF) as the initiator at 122° F. (8). This product, when tested in tires, showed tread wear approximating that of 41° F. GR-S. The physical properties of a laboratory Nitrazole tread stock prepared at 122° F. are equal to those of 41° F. GR-S and superior to regular or 122° F. GR-S. The improved properties appear to be the result of increased linearity and less cross-linking in the polymer chain together with an improved molecular weight distribution. This instance is believed to be the first in the study of synthetic emulsion polymers where it has been shown that a change in the polymerization initiator has led to a structural change in the product. The emulsion recipe is very simple and cheap.

Other Monomers

The vinyltoluenes or methylstyrenes can be used in place of styrene in GR-S, provided a proper combination of the isomers is used to make good products (9). Isoprene, 2,3-dimethyl butadiene, (10) 2-alkyl butadienes (11) and 2,3-dialkyl butadienes, of which one alkyl group is larger than the other, are being studied alone and with butadiene and also styrene in dipolymers and tripolymers. Some of these give polymers with good hysteresis properties. Another type of monomer is benzal acetophenone which with butadiene gave 75% conversion in 30 hours at 50° C. (12). The product was 92% soluble in benzene, and the soluble portion had an inherent viscosity of 2.32. Analysis for carbon and hydrogen indicated that all the benzal acetophenone had already copolymerized with the butadiene.

In the polymerization of 2,3-difluorobutadiene and 2-chloro-3-fluorobutadiene the net effect of the introduction of fluorine into butadiene was to decrease the cold resistance by a considerable amount, leaving the tensile properties and solvent resistance relatively unchanged (13).

Further work with a diolefin and a dithiol gave a quantitative yield of a rubbery polymer from a mixture of diallyl, dimethallyl, and 2,6-diallyl phenol and hexamethylenedithiol (14). The intrinsic viscosity was only 0.60.

Redox and Other Systems

A simple and economical redox iron recipe was developed for use at 41° F. with butadiene-styrene and ferrous silicate colloidal dispersion and rosin-type emulsifier (15). The preparation of GR-S was studied in an alkane sulfonic acid emulsion with air as the oxidizing agent and higher alkane sulfinic acids as oil-soluble reducing agents (16). Dodecyl mercaptan and ferric salts are needed to make the recipe function well. Tetradecane sulfinic acid is the most active reducing agent in the series; conversions were 75-80% at 30° C. in six hours, and products have normal solubility and inherent viscosity.

Considerable work was done in attempts to polymerize butadiene and butadiene with styrene by means of Friedel-Crafts and related agents at low temperatures, but to no avail (17). A polybutadiene was prepared at -75° C. with chlorosulfonic acid as the catalyst; conversion was about 50%, product was rubbery and, when vulcanized in a tread formula, gave a tensile strength of only 460 psi. and elongation of 120%.

The disodium soap of the maleic anhydride addition product of ethyl levoprimarate (ethyl maleoprimaric soap) is a satisfactory emulsifier for GR-S polymerization (18).

Butadiene from Petroleum

During the war the largest proportion of butadiene was obtained from alcohol, and butadiene was obtained similarly when the manufacture of GR-S was increased recently. However butadiene from petroleum is cheaper than from alcohol and will produce cheaper GR-S.

Reinforcement

Much work has been done recently in the study of the mechanism by which carbon blacks reinforce polymers, and since carbon blacks are very necessary in the preparation of GR-S vulcanizates, it seems desirable to discuss some of this work. An article, "A Midcentury Review of Rubber Carbons," (19) is worth reading. It has been stated that gel must be generated in the presence of carbon black for good reinforcement, and highly pigmented carbon gel has been confirmed in electron photomicrographs (20). Carbon blacks in general rapidly respond to mixing, and the chain-like aggregates characteristic of reinforcing carbon blacks observed under the electron microscope are practically unchanged after mixing with rubber (21). The amount of polymer bound to the carbon black increases with greater loadings of the black, but, per unit of carbon black, it decreased at the higher black loadings (22). The temperature of mixing has a large effect: higher temperatures increase the amount of binding.

Bound rubber is chemically cross-linked polymer which may be chemically combined with the black or may simply mechanically include the black; the cross-linking reaction may be initiated by an oxidation reaction catalyzed by the carbon black (23). In practically every case studied it was found that the best properties were obtained for stocks by adding the carbon black very rapidly on a cold mill and by giving the mixed stock additional milling at a temperature of approximately 160° F. (23).

The uniformity of dispersion of carbon black in rubber is determined better by autoradiography than by the usual tensile strength, elongation, and modulus values (24). The carbon black is prepared by being degassed and heated with radioactive $C^{14}0_2$ for 5.5 hours at 900-1000° C. The resistivity test reveals differences between blacks of the same type; therefore it is a simple and sensitive test for characterizing blacks and should be useful for quality control of production and for specification purposes (25). It is of interest that Graphon, a non-commercial type of black gives clear supernatant liquids when shaken with solutions of gel-free GR-S; the greatest sorption is obtained from *n*-heptane solution (26).

Tread Wear

It is stated that the rubber and the carbon black in the construction of a tire tread act independently with respect to tread wear, and the absence of interaction between the effects of black and rubber on tread wear permits the evaluation of the tread wear of a tire if the wear values associated with the rubber and with the black are known (27). The weight method for evaluation of tread wear has advantages in spite of lower precision, as compared with the depth method, and becomes almost indispensable for a valid comparison of treads of different design.

The use of a 30-mesh stainless-steel screen has been

advocated instead of the ASTM garnet paper as the test surface on a National Bureau of Standards abrader because it placed the samples in proper order according to the road wear of the stocks (28). The screen provided a uniform test surface whose wearing action was maintained over long periods of service.

Polymers for Low-Temperature Applications

It is of importance that copolymers for low-temperature applications require less styrene than GR-S, 8.7 to 16.0%, copolymerized at 86 to 122° F. (29) The best plasticizers for reducing the cold compression set of GR-S at -35° F., low volatility, and low extractability with water have been selected from a total of 181 listed substances and found to be esters of long-chain dibasic acids and of phosphoric acid: namely, di-2-ethylhexyl adipate, azelate, and phosphate; dibutoxyethyl adipate; di-2-ethylbutyl azelate; di-*n*-octyl phosphate; and dihexyl, dicapryl, dioctyl, and diisooctyl sebacate (30). An arctic polymer containing 13% styrene, GR-S-1503, is used for applications for defense purposes in the neighborhood of -60° C. (31). An interesting study of nine low-temperature tests has been made by four laboratories on nine polymers, and the published results corroborated the statements given above about a low proportion of styrene (32). The chemical nature of the monomer units determines the intermolecular forces and influences especially the temperature range in which rubber elasticity is exhibited, the swelling in organic liquids, and the permeability to gases (33). Under prolonged constant strain at a low temperature greater than that of the second-order transition, all elastomers studied crystallize more or less, and the crystallization depresses the stress (34).

Ozone Testing

This has been an unusual year for the study of ozone cracking and testing. Infrared specrograms of films cast from treated solutions show progressive intensification of clearly defined absorption bands at 2.9 and 5.8 mu, reflecting the functional groups hydroxyl and carbonyl, respectively (35). In a study of the cracking of natural rubber and GR-S in ozone at different temperatures and elongations, it was found that the natural rubber compound cracked at lower temperatures and elongations than either regular GR-S or cold GR-S compounds (36). For each temperature there existed an elongation below which no sample cracked; this elongation is termed the "cracking-threshold" for the temperature. In a method of ozone crack depth analysis for rubber the crack depth is measured in a cross-section made normal to the length of the crack by using a 20x microscope and noting the life of vulcanizates over hours of time (37). Unless a polymer is handled and compounded properly, good ozone resistance is not obtained, and rubber cured under strain cracks faster than when cured at rest (38). Carbon black, regardless of type, particle size, structure, and physical properties imparted, does not affect the rate or degree of checking and cracking in natural rubber or low-temperature GR-S compounds when subjected to weather or ozone exposure (39). A new test chamber has been built with control of ozone, humidity, light, and temperature from -50 to 100° C. (40). Frosting is the final product of the slow oxidation of the rubber hydrocarbon produced or catalyzed by ozone (41). Ozone stands alone as the cause of exposure check-cracking of rubber, and the authors of a paper from Los Angeles concur (42). The concentration of ozone in the atmosphere in the Los Angeles area is very high.

Latex

Plant production of cold latex with 50% solids has reached substantial proportions, and improved formulation and stringent measures to minimize oxygen in the system have resulted in reaction rates almost double those originally obtained (43). Creaming is feasible for 60% solids latex. Cationic latices, volatile base latices, and fixed base cold latices are all being manufactured (44). The simplest volatile-base latex manufactured is with morpholine laurate emulsification to 49.5% solids at elevated polymerization temperatures, and heat concentrated to 60% solids.

Masterbatches from carbon blacks with GR-S latices improve the quality of the product, maintain cleaner fabricating plants, reduce milling time and power consumption during mixing, and simplify materials handling (45). It has been shown that by proper choice of styrene content, approximately 10% bound, GR-S foam rubber can be made that is superior to *Hevea* foam in subzero properties (46). There are now available in this country nearly 200 synthetic rubber, plastic, or plasticizable polymer latices, and these have been grouped into 15 classes according to their reported composition (47). Some of these are water-dispersible polymers (for hydrosols), water-soluble polymers (polyelectrolytes and hydrophilic compounds), and plastisols (resins dispersed in plasticizers). They are in a wide variety of uses.

Odor, still a major problem, is slowly being removed.

Adhesives

With more and more rubber-like polymers being manufactured, the adhesives are growing in volume. Two panel discussions have been held on rubber-to-metal bonding, one in Los Angeles (48) and one in Chicago (49). Discussions were held on several subjects, and tables of adhesives, their composition and use, and questions and answers were given and recorded. Such panel discussions are much worthwhile. The latest publication gives a copolymer of butadiene and methacrylic acid as a very good rubber-to-steel adhesive (50). Copolymers of butadiene and acrylic acid, and of isoprene and methacrylic and acrylic acids are good adhesives, but the butadiene-methacrylic acid copolymer has the greatest adhesive strength even though it is less soluble; furthermore, it is less subject to rapid autoxidative degradation.

Sodium Elastomers

Sodium elastomers are of interest because of their history and their method of manufacture and their properties; yet they are not manufactured to any extent, probably not at all in this country. Their processibility and hysteresis properties are very good, but their tensile strength is low. The poorer properties may be due to the high proportion of 1,2 addition, which is 45-80%; whereas emulsion polymers generally have low 1,2-addition of only 18-23%, as shown recently by means of infrared absorption (51). The second-order transition temperature of the sodium-catalyzed polybutadiene polymerized at 30° C. was -45° C. and the 75° C. sodium polybutadiene had a value of -64° C.

Alfin Polymers

Alfin polymers are intriguing because of their unusually high molecular weight and general freedom from gel and also because of their rapid polymerization. The catalyst can be varied, but usually it consists of a mixture of allyl sodium, sodium isopropoxide, and sodium

chloride (52). Recently rapid rates of polymerization were achieved with butadiene, acrylonitrile, methyl acrylate, and methyl isopropenyl ketone, and slower rates with styrene, isoprene, 2,3-dimethyl butadiene, alpha-methylstyrene, vinylpyridine, methyl methacrylate, and isobutylene (53). Copolymerization was obtained of butadiene and styrene, alpha-methylstyrene, and 2-vinylpyridine. The intrinsic viscosity of the polybutadiene increases as the reaction temperature is raised and decreases as the conversion proceeds.

Alfin polymers are only in the laboratory stage and probably will not be available for some time.

Hycar

Hycar 1042, an oil-resistant nitrile rubber is the first cold rubber to be produced and marketed by a privately owned plant; it has improvement in tensile strength and elongation (54).

Neoprene

An improved neoprene Type WRT is a modification of Type W but WRT has much greater resistance to crystallization both before and after vulcanization (55). It also has a high degree of resistance to compression set over a temperature range as broad as -40 to 150° C.

Permalux (di-o-tolylguanidine salt of dicatechol borate), Retarder W (salicylic acid), and 2-MT (2-mercaptothiazoline) in the presence of sulfur are efficient accelerators for the vulcanization of neoprene Type W, and they are unique in that the processing safety of stocks containing them is easily controlled by the type and the amount of metallic oxides used without affecting the properties of the vulcanizates (56). Neoprene Type KNR can be plasticized to a greater extent than Type GN by the addition of Accelerator 552 (piperidinium pentamethylene dithiocarbamate) on a cold mill and then easily dissolved (57). Litharge is used with this accelerator, and litharge combinations are also water resistant.

The addition of fillers impairs the ozone resistance of neoprene in proportion to the amount used, and unsaturated vegetable oils and their derivatives, as well as wood rosin, are also beneficial to ozone resistance (58).

Butyl Synthetic Rubber

A very recent article gives a good review of the butyl inner-tube problems and excellent descriptions with additional information on processing, splicing, and valve application (59). The higher Mooney GR-I-17 and GR-I-18 polymers have a slightly higher proportion of diolefin residue, and during the early stages of mixing a minor degree of scorch is introduced by small additions of a very active cross-linking material, such as p-dinitrosobenzene (Polyac).

In the dispersion of SRF carbon black in butyl rubber good correlation is obtained between electron photomicrographs and light transmission measurements of dilute solutions of the compounds, and thus a simple photometric analytical method for the measurement of carbon black dispersion is provided for research or control (60). Milling conditions cause significant variations in the dispersion of SRF carbon black in butyl rubber, and analysis of the phenomena has led to the conclusion that they may be interpreted as evidence of pigment-polymer association (61).

Silicone Rubber

An announcement has just been made that a new silicone rubber compound has tensile strength and elongation properties approximately double the best comparable properties claimed for any currently offered silicone rubbers. These new properties come from the new compounding techniques involving ultra-fine silica pigments with particle size in the range of 0.01 micron. With approximately 20 volumes per 100 of silicone rubber, the tensile strength was 1900 psi. and elongation of 625%, Shore A hardness 68. No particular change is given for other properties (62).

Modulus, torsional stiffness, and % recovery data all demonstrated that Silastic 250 and Silastic 6000 did not show appreciable stiffening until some temperature between -112 and -130° F. was reached; whereas both natural rubber and GR-S were stiff at -76° F. (63). By carefully controlling the induction period in conjunction with the Gehman cold flex apparatus these Silastics demonstrate both a supercooling effect and very rapid crystallization.

A very interesting discussion has just been published on the intra-chain and interchain forces of linear siloxanes (64). The intrachain forces are those of internal rotation—bending and stretching—which control chain stiffness and the ability to coil and are modified by replacing the oxygen with other groups. Interchain forces are those of slipping, sliding, and gliding which represent the effect of polymer molecules on their neighbors. Lack of time and space prevents full discussion of these forces.

An excellent review and bibliography of silicone rubber was published almost a year ago (65).

Polyacrylic Rubber

Polyethyl acrylate can be vulcanized with alkaline reagents which cause the formation and removal of ethyl alcohol through a Claisen type of condensation; the ethoxyl radical of the ester group goes out with an alpha-hydrogen atom from another chain (66). This type of reaction is reminiscent of early laboratory work in organic chemistry for the preparation of acetoacetic ester. The alcohol can be recovered in a high vacuum at high temperatures, but ordinarily it just remains as a plasticizer. The corresponding polyethyl methacrylate, which has a methyl group in place of the hydrogen atom, does not react this way at all.

Hypalon S-2

Here is a new elastomer that is well worth considering because it is stated to be the most durable ever offered for use in the rubber industry, and the company manufacturing it is not in the habit of making statements that it cannot back up with facts (67). Hypalon S-2 is suppplied in a white, spongy, matted form that can be processed with conventional rubber machinery and cured into products that combine complete resistance to ozone; excellent resistance to abrasion, heat, sunlight, that is, weathering in general; has unusually good flex-life and resistanace to crack-growth; and has low water absorption, but high hysteresis properties. It is a chlorosulfonated polyethylene (polythene) and contains 27.5% chlorine and 1.5% sulfur. The elastomer can be vulcanized with magnesia, litharge, tribasic lead maleate (Tri-Mal); sulfur-type accelerator Tetrone A, mercaptobenzothiazole (Captax), diphenylguanidine; and organic acids, Stabelite resin, and and wood rosin. Its uses are said to include tire treads, weather stripping, coated fabrics, footwear, wire and cable insulation, and many others. Because the polymer does not require carbon black for reinforcement, it can be made into serviceable compounds of various colors.

Vulcollans

There should finally be added a brief description of the German Vulcollans which have special properties and a special method of manufacture (68). This material is now in the pilot-plant stage. The elastomer is formed by polyesterifying adipic acid and ethylene glycol, reacting the polyester with a diisocyanate, 1,5-naphthalene diisocyanate, and then cross-linking with water. Under the proper conditions of reaction of the polyester with the diisocyanate in the presence of water, the fluid state slides smoothly into the plastic state and finally to the elastic solid material insoluble in the usual solvents. If the reaction is stopped at the right time during the plastic, deformable state, there is a definite period of 6-12 hours during which the material can be milled, sheeted, and calendered; and if the interruption takes place at a very early stage of plastic deformability, the material can be extruded. The reaction can later be completed by reheating at 130-150° C., a process that may be likened to vulcanization. Fillers can be incorporated in the melted polyester, but only to a very limited extent in comparison with other rubbers.

The products thus obtained are claimed to be highly elastic, have unusually high tensile strength, excellent abrasion resistance (without carbon black), good aging qualities, and very good tear resistance. Because of the absence of oxidizable double-bonds, the products are completely resistant to ozone. They resist oils, gasoline and to some extent benzene, absorb water, and have a high freezing point.

If, instead of water, glycols are used as cross-linking agents, castable products are obtained which can undergo subsequent cross-linkage by heating. Chemically the difference is that while the action of water leads to the formation of urea bridges with separation of carbon dioxide, the reaction with glycols results in the formation of urethan derivatives without separation of carbon dioxide. By this means a semi-finished product can be stored and finished later by heating in molds.

At present the vulcollans are used in heels, which wear ten times longer than those from natural rubber, insoles, solid tires, cycle tires, cable covers, and cellular products called Moltoprenes, produced by using the carbon dioxide as the blowing agent.

This material is not cheap, but it is very interesting and worth watching.

Summary

Of the two types of GR-S now being manufactured about 55% is cold rubber, that is, GR-S polymerized at 41° F. instead of 122° F. Cold GR-S is better than natural rubber for tread wear, but natural rubber still develops less heat and is better for carcass stocks. Oil-extended and plasticized GR-S gives tread wear as good as or slightly better than cold GR-S. Nitrazole CF is used as an initiator to produce a product at 122° F. that is approximately the same in its properties as cold GR-S polymerized at 41° F. It is the first instance where an initiator has led to a structural change. Other monomers, redox systems, and reinforcement by carbon black are discussed. The weight method is said to be better than the depth method for evaluation of the tread wear.

Stainless steel screen is advocated in place of garnet paper for the National Bureau of Standards abrader. GR-S type of copolymers for low-temperature service should contain not more than about 16% styrene. Aging tests now lean toward work on the action of ozone. New work on cold GR-S latex, adhesives, sodium elastomers, and Alfin polymers is included. Neoprene Type WRT is a modification of Type W, with greater resistance to crystallization and a high degree of resistance to compression set. A minor degree of scorch is introduced into butyl rubber by small additions of p-dinitrosobenzene.

Silicone rubber with a tensile strength of approximately 2000 psi. and an elongation of 625% by means of ultra-fine silica has just been announced. The mechanism of vulcanization of polyacrylic rubbers involves a Claisen reaction with loss of alcohol. Hypalon S-2 is a new elastomer prepared by the chlorosulfonation of polyethylene. It can be vulcanized by different agents, has excellent weathering properties, and needs no carbon black for reinforcement.

The German Vulcollan, which also needs no carbon black for reinforcement, is prepared from adipic acid and ethylene glycol and vulcanized with a diisocyanate and water or glycol. It can only be handled under special conditions, is very strong, is rather expensive, and at present is only in the pilot-plant stage.

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(Continued on page 712)

[1] Abstract.

Methods Employed in Compounding Research—IV[1]

Ingredients for Compounding Research

I. Drogin[2]

THE following installment continues the section on ingredients for compounding research which was begun in our December, 1952, issue. Part I of this series appeared in our October, 1952, issue.

Butyl Synthetic Rubber (GR-I)

Butyl synthetic rubber (GR-I) is a copolymer of isobutylene and isoprene to which standard rubber antioxidant has been added during manufacture. Butyl is a vulcanizable hydrocarbon rubber not readily attacked by oxygen, ozone, acid, alkali, and other chemical agents harmful to crude rubber. Its low unsaturation is believed to account for many of the outstanding properties of butyl rubber vulcanizates. Applications include inner tubes, tire curing bags, wire and cable insulation, adhesives, tank linings, proofed goods, gaskets, seals, steam hose, molded and extruded goods, conveyor belting, footwear, pontoons, sporting goods, toys and many others. Available commercially are eight GR-I types of synthetic rubbers from the Synthetic Rubber Division, Reconstruction Finance Corp. (74)[3], and five Polysar types from the Polymer Corp., Ltd. (75). These are listed in Table 6.

[1]Based on a paper presented before the Ontario Rubber Section, C. I. C., Toronto, Ont., Canada, Mar. 11, 1952; The Los Angeles Rubber Group, Inc., Los Angeles, Calif., Apr. 1; and the Northern California Rubber Group, San Francisco, Calif., Apr. 10.

[2]Director of research, United States Carbon Co., Charleston, W. Va.

[3]Numbers in parentheses refer to Bibliography items at the end of this installment. For references (1-35) see our Oct., 1952, issue, p. 69; (36-62), Dec., 1952, p. 369; (63-73), Jan., 1953, p. 509.

Properties

Many properties of butyl rubber vulcanizates excel those of natural rubber. Butyl's air-holding ability is eight or ten times better than that of natural rubber.

TABLE 6. IDENTIFICATION OF BUTYL (GR-I) TYPE SYNTHETIC RUBBERS

Designation	Isobutylene/ Isoprene/Ratio	Antioxidant	Polymer Viscosity†	Modulus‡ 40 Min. psi.	Special Features	Uses
A. GR-I Synthetic Rubber Division, RFC*						
GR-I	98.0/2.0	PBNA	41–49	875–1125	Low percentage of isoprene, slow curing, good electrical properties, and resistance to many chemicals	
GR-I-15	97.5/2.5	PBNA	41–49	1125–1375	Faster curing than Standard GR-I: general-purpose butyl	Commonly used for inner tubes
GR-I-16	97.5/2.5	PBNA	50–60	1125–1375	GR-I-15 type with higher Mooney viscosity	Commonly used for inner tubes
GR-I-17	97.5/2.5	PBNA	61–70	1125–1375	GR-I-15 type with higher Mooney viscosity	Commonly used for inner tubes and in cements
GR-I-18	97.5/2.5	PBNA	71 min.	1125–1375	GR-I-15 type with higher Mooney viscosity	Commonly used for inner tubes and in cements
GR-I-25	97.0/3.0	PBNA	41–49	1325–1575	Higher percentage of isoprene, faster curing	Largely for curing bags
GR-I-40	98.0/2.0	PBNA	30–40	875–1125	Similar to Standard GR-I, but lower Mooney viscosity	
GR-I-R-21§	98.5/1.5	PBNA	38–47	Lower than GR-I	Slower curing than Standard GR-I; superior ozone resistance; may contain a peptizing agent to maintain narrow Mooney viscosity range during production	In insulation on wires designed to carry high voltage

B. Polysar Butyl—Polymer Corp.¶

Polymer Code	RFC Equivalent	Antioxidant	Polymer Viscosity	Modulus‖ 20 Min.	40 Min.	80 Min.	Special Features	Uses
Polysar Butyl 100	GR-I-21	Staining	41–49	350– 525	550– 770	750–1615	Excellent resistance to ozone	Wire and cable
Polysar Butyl 200	GR-I	Staining	41–49	575– 775	875–1125	1200–1500	Faster curing than Polysar Butyl 100, but still extremely resistant to oxidation	Inner tubes and mechanical goods
Polysar Butyl 300	GR-I-15	Staining	41–49	750– 950	1125–1375	1475–1775	Faster curing than Polysar Butyl 200	Inner tubes
Polysar Butyl 301	GR-I-18	Non-staining; Non-discoloring	70–80	750– 950	1125–1375	1475–1775	Cures at same rate as Polysar Butyl 300; has best low - temperature performance of all butyl types	Inner tubes and mechanical goods
Polysar Butyl 400	GR-I-25	Staining	41–49	900–1000	1325–1575	1750–2050	Fastest curing butyl polymer	Bicycle inner tubes and tire curing bags

*Synthetic Rubber Division, Reconstruction Finance Corp., 811 Vermont Ave., N. W., Washington 25, D. C.
†ML 8 at 212° F.
‡At 400% elongation when tested according to the procedure given in the "Specifications for Government Synthetic Rubber," Synthetic Rubber Division, RFC.
§Experimental type.
¶Polymer Corp., Ltd., Sarnia, Ont., Canada.
‖At 400% elongation, at 307° F.

Butyl's excellent heat and age resistance, high resistance to gas permeation, good tear resistance, electrical properties, and resistance to animal fats, vegetable oils, and certain chemicals are outstanding.

Butyl compounds, for the most part, do not harden on heat or oxygen aging, even in the presence of high sulfur or accelerator concentration. Instead, they eventually become softer. Consequently in the developing of stocks to meet severe aging requirements, emphasis is placed on minimum modulus loss after aging. Stocks should be compounded to the highest initial stiffness compatible with the service for which they are intended.

Butyl has a high degree of natural tackiness. Uncured lightly loaded butyl stocks have a tendency to flow under their own weight more than natural rubber stocks, when allowed to stand for long periods of time, particularly at high temperatures. It is possible in many cases to overcome cold flow problems by proper compounding techniques.

According to Iknayan (76), the raw tenacity of butyl compounds may be improved by introducing a minimum degree of scorch during early stages of mixing by adding a very small amount of a very active cross-linking material p-dinitroso benzene (Polyac).

Because of the low degree of unsaturation in butyl rubber, care should be exercised to prevent contamination of butyl by materials having a high degree of unsaturation, such as natural rubber, reclaim, and some synthetic rubbers. Butyl compounds in proportion as low as 1% are serious contamination for natural rubber, GR-S, and nitrile type rubbers. Results of contamination are cure rate irregularities, blown and blistered vulcanizates, and stocks with low physical properties.

Processing

Butyl does not require premastication because it does not react to ordinary mastication or plastication such as that used for breaking down natural rubber. Very little permanent change in plasticity may be obtained by prolonged milling or mechanical working. The Mooney plasticity of raw butyl may be decreased by using a chemical peptizing agent such as RPA #2, #3, or #5, generally less than one part of peptizer per 100 parts of polymer, together with mechanical mastication at high temperatures (over 250° F.), being required.

Butyl rubber may be handled in standard rubber machinery. It is best mill-mixed on a cold, tight set mill. Approximately 10% larger volume loads may be charged to the Banbury when mixing butyl than when mixing natural rubber. Smooth extrusions of butyl are obtained by loading the compound with at least 20 volumes of carbon black or 30 volumes of mineral fillers to deaden the nerve. According to Beckwith, Welch, and Nelson (77), as the particle size of the carbon black increases, the stock strength and the tack strength both decrease. Pure gum extrusions are difficult to make. Extrusion rates of loaded compounds may be increased by obtaining a good balance between fillers and softeners.

Butyl cements may be made with a higher percentage of solids than natural rubber cements. Butyl stocks containing mineral fillers usually cut in naphtha more readily than similarly compounded natural rubber stocks. Stocks containing thermal decomposition blacks and semi-reinforcing furnace blacks cut at approximately the same rate as similar natural rubber stocks. Stocks containing channel black usually require longer churning periods.

The cure rate of butyl compounds depends upon the type of vulcanization and upon the type of butyl rubber used. Compared to natural rubber, the cure rate of standard butyl is slower, requiring higher temperatures or longer curing times with sulfur-accelerator type of cures. Dioxime cures provide a faster cure rate, approaching that of natural rubber. The most rapid sulfur vulcanization of GR-I, according to Baldwin, Turner, and Zapp (78), requires the use of ultra-accelerators.

According to Lightbown, Verde, and Brown (79), contrary to natural rubber and GR-S practices, the incorporation of carbon black in a butyl inner tube recipe is primarily to improve processability. It is not employed as a means of developing increased tensile strength, although it does raise modulus and enhance tear resistance to a much greater extent than do other pigments.

In spite of its high nerve, butyl will flow to a greater extent than natural rubber in a prolonged period of time. In inner tube manufacture this property results in fold marks or sidewall breakdown of tube sections if they are stored on trays for extended periods. The use of 20 parts of EPC black in a butyl tube compound was found to minimize cold flow.

A mixture of EPC and SRF blacks is employed in order to minimize bruising and reduce cold flow. A total loading of 50 parts of black is used to reduce nerve and tend to overcome shortness.

When butyl synthetic rubber is compared with natural rubber, one of the major differences found is in the lower chemical reactivity with sulfur in the presence of accelerators which, therefore, results in a slower rate of vulcanization.

Butyl inner tubes, according to Adams, Buckler, and Wanless (80), often form longitudinal folds or buckles which cause tires to go flat by chafing through at the creases. Other problems in connection with the utilization of butyl for inner tubes are, according to Iknayan (76), uncured compound strength, tube shaping operations, splicing, valve application, and compound segregation. It appeared that buckling might be prevented by a light coating of soap solution on the surface of the tube as well as curing temperature of 350° F. and higher which would be feasible and beneficial. The problem, according to Buckley, Marshall, and Vickers (81), and Iknayan (76), was fairly well solved by the use of higher molecular weight, higher viscosity, higher modulus, and faster curing types butyl (GR-I-17 and GR-I-18) plasticized with as much as 25 parts of petroleum oils, high-temperature cures, and judicious choice of carbon blacks in the tube compounds. Also the stiffness of butyl can be efficiently reduced by the action of plasticizers from petroleum which lubricate the material internally to provide a softer and more resilient inner tube.

Neoprene Synthetic Rubbers—Dry and Latex Types

Neoprene is polymerized chloroprene. A variety of physical properties and combinations thereof may be obtained in the final product by varying the conditions of polymerization. Neoprene is more like natural rubber in many physical properties than any of the other synthetic rubbers. Vulcanizates of neoprene are greatly superior to natural rubber compounds in several specific properties such as deterioration by oxidation, heat, sunlight, ozone, corona discharge, flame, and especially the swelling action of oils and solvents.

Dry Types

Available commercially (82) are the ten dry types and the six latices, all of which are identified in Table 7. As pointed out by Byam (83), Types GN (84) and GN-A (85) are older general-purpose neoprenes; the difference is that Type GN-A contains 0.5% antioxidant, which gives the material more stability in the sense that it changes with time and temperature less rapidly than Type GN in Mooney viscosity, stickiness, and rate of

TABLE 7. IDENTIFICATION OF NEOPRENES

A. DRY TYPE NEOPRENES

Type	Description	Suggested Uses	Mixing	Processability		
				Calendering	Extruding	Fabricating
GN	General-purpose type chloroprene polymer stabilized by a thiuram disulphide instead of a discoloring type antioxidant. For use in all products, including light-colored and non-staining goods. Fast curing type. Sp. gr. 1.25. Appearance, amber-colored rods. Odor, none. Storage stability, approximately one year	Hose tubes, white sidewalls, light-colored covers for hose, wire jackets, heels, soles, belting, rolls, coated fabrics, molded and extruded goods, blown sponge	Breaks down rapidly. Becomes soft and sticky on continued mastication	Calenders well. Requires close temperature control	Excellent extrusion qualities. Add Type S to prevent collapse	Tack is good although, upon standing, warming may be required
GN-A	A chloroprene polymer stabilized with a thiuram disulfide and containing a discoloring antioxidant. Sp. gr. 1.23. Appearance, amber-colored sticks. Storage stability, very good, better than Neoprene type GN. For all products except light-colored and non-staining goods	Jacketing for wire, hose covers and tubing, solid tires dark-colored thread, flat V-belts, rolls, heels, soles, extruded and molded goods, coatings for metal and fabrics, blown sponge	Breaks down readily. Becomes soft and sticky on continued mastication	Calenders well. Requires close temperature control	Excellent extrusion qualities. Add Type S to prevent collapse	Tack is good although, upon standing, warming may be required
W	A chloroprene polymer with more uniform weight distribution; contains no sulfur, thiuram disulfide, or antioxidant. Sp. gr. 1.23. Appearance, silver-gray sticks. Plasticity standard, 47 ±5 Mooney viscosity. A neoprene with excellent storage stability and improved processing; stocks mill and calender with less sticking and handle with less distortion or collapse, and with a wide latitude in compounding. Its vulcanizates possess unusually low compression set	Brightly colored jackets for wire and hose covers. Low set mechanical goods, soft rolls, sponge veneer, cut thread, and curing-type adhesives	Bands readily. Softens slightly on continued mastication	Calenders well over wide range of temperature	Extrudes smoothly. Resists distortion or collapse	Warm to improve tack and flexibility
WRT	A stabilized chloroprene polymer having uniform molecular weight distribution. Contains no sulfur and thiuram disulfide. Is not a blend of other neoprenes. Sp. gr. 1.25. Appearance, silver-gray sticks. Improved fabrication properties; stock has superior retention of tack and flexibility, even when stored at low temperatures. Resembles Type W in all properties except that its rate of crystallization is much slower	Friction stocks for hose, belts and tires; for rolls, extruded and molded goods, sheeted stocks for footwear	Breaks down readily. Becomes soft and sticky on continued mastication	Excellent for frictioning and coating	Excellent extrusion qualities. Add Type S to prevent collapse	Retains tack even at low temperature. Does not lose its flexibility
GRT	A chloroprene polymer stabilized with a thiuram disulfide and containing a non-discoloring antioxidant. Sp. gr. 1.23. Appearance, amber-colored sticks. Storage stability, very good. An improved all-purpose neoprene superior to Type GN in retention of building tack and flexibility of uncured stock, as well as in storage stability. Replaces RT.	.....	Breaks down readily on mill or in a Banbury mixer. Tends to become soft and tacky on prolonged milling	.....	.....	Superior resistance to hardening due to elastomer crystallization
S	An unmodified chloroprene polymer stabilized with a small amount of a thiuram disulfide and containing a non-discoloring antioxidant. Sp. gr. 1.20; appearance, amber-colored sticks; storage stability, very good. A tough neoprene which does not soften on continued mastication	Crepe soles. A stiffener for other neoprenes to improve processing, allow increase in softener for low-durometer stocks, or for low-temperature service.	Will not break down, even on continued mastication	Crepes well. Can be reworked without softening	Used to stiffen other neoprenes	Warm to improve tack
AC	A modified chloroprene polymer having a specific gravity of 1.23; supplied as short sticks. Soluble in the solvents and blends of solvents customarily used for dissolving other types of neoprene. A quick setting, non-staining neoprene for light-colored solvent adhesives with good storage stability.	Shoe and industrial adhesives	Bands readily. Softens only slightly on continued mastication	Soft grades go into solution without plastication		
CG	A quick setting non-staining neoprene for solvent adhesives; freezes quickly at normal temperatures, to result in a high initial bond strength not obtainable with other elastomers.	Shoe and industrial adhesives	Breaks down readily. Becomes soft on continued mastication	Freshly manufactured material will not go into solution without plastication. Aged material is more soluble.		
Q	Highly oil resistant non-crystallizable neoprene; a copolymer of chloroprene and acrylonitrile stabilized with thiuram disulfide and containing a discoloring antioxidant. Sp. gr. 1.23; appearance, brown plasticized sheets; characteristic odor; storage stability excellent	A special-purpose neoprene designed for oil service too severe for other neoprenes	Has a high plasticity with practically no nerve; handles very will on the mill	Extrudes and calenders exceptionally well		

TABLE 7. IDENTIFICATION OF NEOPRENES (*Continued*)

A. DRY TYPE NEOPRENES

Type	Description	Suggested Uses	Mixing	Processability: Calendering	Processability: Extruding	Fabricating
KNR	A highly modified chloroprene polymer stabilized with a thiuram disulfide. Sp. gr. 1.23; appearance, amber-colored sticks; storage stability good. An easily plasticized neoprene for high solids, solvent cements	Surfacing materials, tank linings, floor covering, caulking compounds. A softener for other neoprenes to improve processing or allow increase in amount of filler	Softens by mastication and/or chemical plasticizers to a greater extent than any other neoprene	Softened material absorbes solvent readily		

B. Neoprene Latices

Type	Description	Properties: Solid Content	Sp. Gr. at 25° C.: Wet Latex	Sp. Gr. at 25° C.: Dry Neoprene Solids	Initial pH	Average Limit Viscosity Cps.	Odor	Stability* Toward Compounding
571	An all-purpose neoprene latex suitable for use in all types of products	50±1%	1.10	1.23	12.4±0.2	8	Characteristic	Excellent
572	A neoprene latex designed primarily for adhesives; fast setting, high wet strength type	50±1	1.10	1.23	12.2±0.2	9	Characteristic	Good
601-A	An all-purpose high solids neoprene latex made by creaming Type 842-A. For dipped and coated goods and for sponge	59±1	1.12	1.23	12.2±0.2	..	Slight	Excellent
700	Designed primarily as a saturant for paper or other cellulosic material	50±1	1.0	1.19	12.4±0.2	14	Slight	Excellent
735	A soft-type neoprene latex specially suited for paper making; designed primarily for addition to cellulosic pulp or other fibers at the beater	34±2	1.06	1.23	12.2±0.2	6	Characteristic	Good
842-A	An improved all-purpose neoprene latex better than Type 842. For bonding wool, hair, or other fibers	50±1	1.10	1.23	12.4±0.2	9	Slight	Excellent

*All types have good storage stability; all have very good mechanical stability except 572, which is rated "good".
NOTE: All types are off-white in color except 700, which is of cream color.

cure. Type GN-A is considered definitely superior to Type GN.

Type W (86) is a general-purpose neoprene which has much greater stability or resistance to change due to time and temperature than either GN or GN-A. Type W is also somewhat better in color and in processing. It does, however, tend to crystallize more than is desirable and, for this reason, Type WRT (87) was developed. This type has all of the characteristics of Type W plus a very much greater resistance to crystallization. It is believed that it is a much better material for general use than even Type W.

While Type GRT (88) does replace the older Type RT (89), the former was developed as a definite improvement over RT rather than as a mere replacement. It has the same resistance to crystallization as RT and as WRT. It is, however, a much better processing neoprene than Type RT.

Type S (90) is an unmodified neoprene tougher than any other. It does not smooth down on break down or milling and hence is especially suitable for use in crepe soles. It is also used fairly widely as a stiffener for neoprene compositions made with other types.

Types AC (91) and CG (92) have a very high crystallization factor which makes them especially suitable for adhesive cements. Type CG is made in the so-called G system and, like GN, is subject to considerable change in plasticity with time and temperature. Type AC is made in the same system used for Type W and has greater stability. It changes very little in raw form or in solution as far as plasticity or solution viscosity is concerned.

Type KNR (93) is a highly modified neoprene and is subject to peptization by various chemicals, especially by thiurams and dithiocarbamates. It is used principally in coating compositions which are required to be very soft. Very high solids cements can be made with Type KNR where only small amounts of solvents may be tolerated. It is used for sprayable brushable cements and putty-like compositions used widely for various types of maintenance coatings.

Type Q (94) is an interpolymer of chloroprene and acrylonitrile and, of course, has the very much increased resistance to swell that is characteristic of acrylonitrile interpolymers. It is further characterized by lack of nerve, which helps it to be milled and calendered very easily and smoothly.

Latices

The latices are alkaline aqueous dispersions of neoprene. Types 571 (95-96) and 842-A (95) are general-purpose latices, and many users prefer one or the other for reasons of their own. Type 601-A (95) is a concentrate of 842-A; the concentration is effected by creaming. Type 572 (95, 97) was developed and is used for adhesive compositions because it has less stability to mechanical pressure than Type 571. As a result of this condition, strong initial bonds are developed quickly by applying pressure. Ultimate bonds, when the water is entirely eliminated and cure has taken place, are about the same as if Type 571 were used.

Type 700 Latex (95, 98) gives a soft film making it more suitable than other latices for saturation work, such as the impregnation of soft paper compositions.

Type 735 (99) was developed especially for applications to paper where it is possible to add a latex through the beater. Small amounts of Type 735 Latex add substantially to the strength of the paper and particularly to the wet strength of paper.

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(To be continued)

Practical Compounding

(*Continued from page 639*)

In Figure 26 are shown the pound-volume costs of each of these compounds as the price of natural rubber is varied from 20 to 30¢ a pound. When the price of natural rubber is under 22.25¢ a pound, stock A is the cheapest, and above that price, stock E becomes the cheapest. If it is possible to use a stock with only 200 psi. modulus as compared with stock A with a modulus of 1000 psi., stock E should be chosen. If modulus values nearer to those for stock A are required, then stocks C and B become the next most desirable and the change to stock C should take place when the price of natural rubber is 24.4¢ a pound or higher.

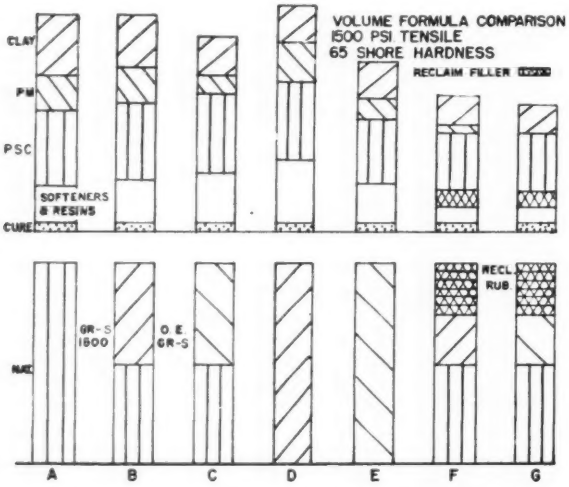

Fig. 25. Volume Formula Comparison for 1500 PSI. Tensile, 65 Shore Hardness Stocks

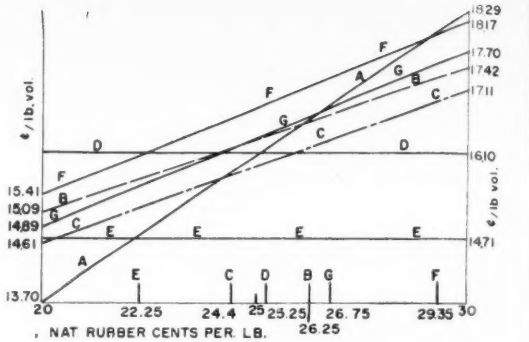

Fig. 26. Cost Changes per Pound Volume as Natural Rubber Price Increases

With the exception of stock D, Figure 25, made with LTP GR-S 1500 as the entire rubber hydrocarbon, all of the stocks in this series are easily processed. Stocks made of all LTP GR-S tend to be sticky on the mill unless compensation is made in the resin-softener portion of the formula. It is recommended that the coumarone-indene resin be kept at not more than 10 parts on 100 parts of GR-S 1500. This reduction in resin content is not serious since GR-S 1500 does not require so much resin reinforcement as does standard GR-S.

By proper combination of oils, waxes, and FF wood rosin, the complete range from tack-free to tacky stocks may be produced. Usually less than one part of wood rosin is sufficient for tack in GR-S stocks containing Purecal SC, but with high loadings as much as two parts may be needed. Tack may be controlled accurately, because differences of as little as 0.1-part (that is, from 0.6- to 0.7-part) of wood rosin may be easily detected.

The laboratories at Wyandotte Chemicals Corp. are making elaborate compounding studies on different rubber systems including those shown above from which stocks having tensile strengths from 900 to 3000 psi. are being developed. Some of these will be non-black stocks; while others will contain carbon blacks in addition to Purecals. From these data it will be possible to select stocks from various rubber systems to keep the consumption of different elastomers in balance as far as costs are concerned. It will also permit the selection of different systems of elastomers to meet the same specification, thereby always operating at the lowest possible cost. This work will be published in a subsequent paper.

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Editorials

The Beginning of a New Era and Its Implications

WITH the inauguration of Dwight D. Eisenhower as President of the United States in Washington, D. C., on January 20, a new era in government in this country began. With a Republican majority in the Congress, the responsibility for the present and the future of the country is in the hands of a different political party for the first time in two decades.

Although full of confidence and optimism, the Republicans know they will be criticized just as strongly for their mistakes as they will be lauded for their achievements, and they may be expected therefore to proceed with proper caution.

Business men, in general, have complained of too much interference from the Federal Government and too high taxes, during the past decade, particularly. The new administration is pledged to reduce this interference both with business and with labor and to improve the economic climate for business by reducing taxes, as soon as possible, and consistent with a balanced budget.

In this new era free enterprise will have its biggest chance and by its own energy to determine our future, with no more opportunity to depend on government, according to Leo M. Cherne, economist, talking before the Sales Executive Club of New York, on January 6. He pointed out, however, that labor costs may increase another 5-8%, and prices another 2-3% in 1953, and that we will return to a more competitive economy, with increasing emphasis on selling.

As far as the rubber industry is concerned, the first problem to be solved by the new administration is when and how to dispose of the government-owned synthetic rubber plants. The Reconstruction Finance Corp. is to make its report to the President and the Congress on March 1, following which the President is required to make his recommendations for disposal by April 15, 1953. By April, 1954, the government must be out of the synthetic rubber business, or arrange to continue in it more or less indefinitely.

In the new Congress, jurisdiction on government rubber matters must be decided between the banking and currency committee, in which Sen. John Bricker (Rep., O.), would probably head up a rubber subcommittee, and the Armed Services committee, in which Sen. Lyndon B. Johnson (Dem., Tex.), has a similar interest. In the House the Armed Services committee will have jurisdiction. Rep. Paul Shafer (Rep., Mich.) is a member of this committee most active in the field of rubber.

Reports from Washington indicate that the RFC March 1 report will follow the general approach mentioned by Mr. Cherne. Thus it will be up to the rubber industry to sell Congress on the idea that immediate disposal of the synthetic plants to private industry will be to the best interests of the nation as a whole, and that continued government ownership is no longer desirable or practical. An adequate natural rubber stockpile and recent developments in the technology of the industry, such as, oil-extended and rosin-extended rubbers; the new high-speed, continuous, tube system of polymerization; and the possible increased use of butyl rubber in tires, would seem to add weight to the industry position.

One big unanswered question in connection with this disposal problem, however, is the attitude of the new administration on how the plants may be sold to private industry without any one company or group of companies obtaining a dominating position in the industry. The increasing interest of petroleum and chemical companies in these plants may help to solve this problem.

If and when the synthetic rubber industry is in private hands, an inseparable part of its growth and development is the continuation of a research program in both fundamental and applied fields. RFC has been spending about $6.5 million for research on synthetic rubber in recent years. Can the industry spend as much or more, and will applied research be emphasized so much that fundamental research will suffer? Will a condition develop in five or ten years whereby the industry will take so much from the barrel of basic knowledge without putting enough back into it that the barrel will be empty?

It may be that fundamental research on synthetic rubber should be continued by the Federal Government, if it is to be maintained on a proper scale and without unnecessary duplication. The National Science Foundation Act of 1950 was established to develop a national policy for scientific research, but Congress has only appropriated a total of $8.5 million for research in all fields during the past three fiscal years, and here again the money is used for both fundamental and applied research.

Officials of the National Science Foundation must go before Congress now with a request for $15 million for fiscal 1954. Either the amount necessary for fundamental research on synthetic rubber should become a part of this appropriation, or the industry should give consideration to establishing its own Foundation. The days of government sponsored synthetic rubber research to the extent of $6.5 million a year may be numbered.

We have tried to explain a few of the problems facing the country as a whole and the rubber industry, in particular, which must be solved if the promise of the new era is to be realized. The "chance of a lifetime" is now before the American free enterprise system.

R. G. Seaman

DEPARTMENT OF

PLASTICS TECHNOLOGY

The Effective Control of Lead Dust in the Manufacture of Vinyl Plastics [1]

Alexander E. Goss[2] and Arthur M. Ross, Jr.[3]

IN THE manufacture of articles of commerce from plasticized polyvinyl chloride resin, the use of powdered lead compounds creates a definite health hazard which has been difficult to control effectively. This article will present the results of an investigation by the Bureau of Industrial Hygiene, Connecticut State Department of Health, at a plant producing calendered and extruded polyvinyl chloride film where the manufacturing operations differ considerably from the common practice in this industry. As a result of this change in the manufacturing procedure, the effective control of the lead dust hazard was accomplished with the use of a minimum of exhaust ventilation.

Plasticized polyvinyl chloride products comprise the following ingredients: resin, plasticizer, stabilizer, lubricant, and, usually, a color, filler, or pigment. Powdered lead compounds are encountered in the use of these materials as stabilizers or pigments. The most widely used stabilizers at present are lead compounds; while certain pigments, such as chrome yellow (lead chromate), contain lead. In this article only the lead compounds will be considered because if the control measures are adequate for the lead compounds, they will also be effective with other materials of equal or lesser toxicity now used in this industry.

A periodic industrial hygiene survey should be performed for all the manufacturing processes and operations. Where toxic materials are used, the necessary chemical determinations of the environmental conditions together with medical control of the workers, regardless of the method of control, should be instituted. For food packaging, lead and other toxic compounds are prohibited by law; not only must non-toxic materials be used as ingredients in the manufacture of this type of film, but contamination by toxic materials elsewhere in the plant must be avoided.

Most of the lead compounds used as stabilizers and pigments are light, fluffy, powdered materials. When being handled for weighing, blending, or mixing, they create considerable dust in the workroom atmosphere. Considerable exhaust ventilation must be installed at each point of dust dissemination, and sometimes additional ventilation is needed for the general workroom area. Relying solely on exhaust ventilation has not proved too effective in the control of the lead dust hazard.

Common Manufacturing Process

The common practice in the preparation of polyvinyl chloride compositions is to weigh out all the ingredients into open metal containers. The contents of the containers are then dumped into a steam-jacketed blender and, after mixing, are first transferred to a Banbury mixer and then to a two-roll plastics mill. Until the materials leave the mill, each operation in the process creates considerable dust every time a batch is prepared. A single plastics calender may require from 4-25 batches an hour.

In some cases the lead stabilizer is sifted through a vibrating screen prior to use. This equipment must be completely enclosed and provided with exhaust ventilation. The dumping of the bags of lead stabilizer into the screen hopper and the removing of screened material always subject the worker to excessive concentrations of lead dust. These paper bags sometimes break in handling, and the contents may be scattered over the floor. Disposal of the empty paper bags creates another problem since every time the bags are handled, considerable dust is disseminated into the breathing zone of the handler. The worker who disposes of the bags and sweeps the floor is subject to high concentrations of lead dust.

In the weighing operation each ingredient is scooped from its container and placed into the weighing scale pan. After weighing, it is dumped into a large metal box for transfer to the blender or mixer. The handling of the powdered materials creates dust, no matter how carefully the worker may perform the operation. Since the space required for the weighing operation is large, effective exhaust ventilation is almost prohibitive in cost. In addition to the few window or wall fans usually provided for the weighing operation, the worker wears an approved dust respirator. The worker may wear the respirator during the actual weighing operation, but usually removes it before the workroom atmosphere has been cleared of dust. In most cases the atmosphere has not been cleared of dust from the previous batch when another batch must be weighed out. At the end of the shift the premises are covered with dust, the worker has inhaled excessive amounts of lead dust, and the protection provided by the respirator and the fans has been inadequate.

Management is cognizant of the health hazards resulting from the use of lead compounds and exhorts the

[1] Based on paper presented before the Rubber & Plastics Division, American Society of Mechanical Engineers, New York, N. Y., Dec. 5, 1952.

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[3] Ross & Roberts, Inc., 1299 W. Broad St., Stratford, Conn.

worker to wear his dust respirator at all times. Few workers, however, will tolerate the discomfort of wearing a respirator over the nose and mouth for an entire working day so that this practice provides neither adequate nor effective control.

The dumping of the dry ingredients into the blender or Banbury disseminates additional dust into the workers' breathing zone even though this operation is usually controlled by exhaust ventilation. After the Banbury the material usually goes to a warm-up mill for further mixing prior to final processing. This mill has a canopy hood with exhaust ventilation to capture the vapors and dust from this operation.

It is obvious that the common method of manufacturing plasticized polyvinyl chloride products using lead stabilizers presents a definite health hazard. It requires considerable housekeeping, is expensive with regard to effective and adequate exhaust ventilation, requires the use of a dust respirator for the major portion of the workers' day, and is not conducive to good management-employe relations. Typical concentrations of lead dust in the workroom atmosphere with the common method of manufacturing are given in Table 1.

TABLE 1. TYPICAL ATMOSPHERIC CONCENTRATIONS OF LEAD DUST USING THE COMMON METHOD OF MANUFACTURING

Operation	Lead Concentration,* Mg./Cubic Meter of Air
Weighing	0.36
	2.41
	3.22
	0.42
	0.28
	1.10
Blending	0.68
	0.12
	0.93
	0.17
	0.34
	1.48
Banbury mixing	0.19
	0.23
Dry screening of lead stabilizer	1.04
	0.50
	2.24
Compounding on warm-up mill	1.66
	1.08

*Maximum allowable concentration is 0.15-milligram of lead per cubic meter of air.

New Method of Pigment Processing

The basis of the new method for handling powdered lead compounds and pigments lies in the following innovations: (1) all transfer of dusty materials out of their original containers is restricted to a single exhausted enclosure equipped with the necessary handling equipment, scales, respirator air supply, etc.; (2) whenever possible, dust materials are processed into non-dusty pastes by mixing with plasticizer and subsequent grinding, while batches are made as large as possible to minimize the number of weighings of powdered material; and (3) when processing into paste form is not possible, dusty materials are weighed into plastic bags and hermetically sealed before being brought into the factory proper.

The exhausted enclosure has a slot exhaust 3½ inches high at the floor and running the width of the enclosure. The enclosure is exhausted to an exterior dust collector at the rate of 5,000 cubic feet per minute. The first section of the enclosure is used primarily for weighing in large batches bulk colors into pony mixer cans. The equipment is arranged so that the air flow comes over the operator's shoulder and down toward the floor to move the dust away from his breathing zone. If the dust is toxic or objectionable, the weigher wears an air-supplied helmet.

The pony mixer is equipped with a semi-circular exhaust hood so that any dust raised during mixing is carried off to the dust collector. The slurry produced in the mixer is then transferred to a three-roll paint mill, ground to the desired fineness, standardized, and finally transferred to storage containers. These pastes are sufficiently stable to permit indefinite storage without settling and are delivered accurately and neatly into plastic bags set on the weighing scale pan by means of an air-driven reciprocating pump with hose and hand nozzle. The plastic bags are then sealed and delivered to the Banbury mixer floor. Color pastes too concentrated for convenient weighing may be diluted with resin in a planetary mixer and subsequently weighed into the plastic bags.

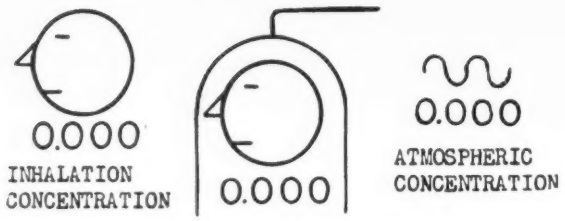
The second section of the enclosure has a ribbon-blade mixer large enough to hold a full drum of lead stabilizer to eliminate the need of reweighing. The ventilation in this section is at the rate of 175-200 linear feet per minute. After the mixer has been loaded, the calculated quantity of plasticizer is metered out into the mixer and combined with the stabilizer. The contents are then pumped into one of two reservoirs located above a pair of colloid mills used to deliver a smooth, stable, non-settling paste into portable drums. From these drums the paste is pumped into plastic bags on the weighing scale in the same manner as the color pastes. This operation eliminates any need of dry screening of the lead stabilizer with its attendant dust clouds.

The third section of the enclosure has two decks, the upper of which is used for storing bags of white pigments which may be used in quantities too large to permit grinding into pastes. The mouths of two storage hoppers project into this upper deck. When bags of powdered materials are being loaded into the hoppers, the deck is exhausted to the dust collector, and the operator wears an air-supplied respirator. At the lower deck a traveling scale receives pigment from one of the hoppers into a plastic bag mounted in a special holder on the scale pan. Flow of material from the hopper is regulated by a foot-pedal which starts and stops the vibratory feeder to permit precise weighing without excessive dust being created. The plastic bags are sealed inside the enclosure before being delivered to the Banbury floor.

Other New Processing Operations

In this plant the polyvinyl chloride resin which represents approximately two-thirds the total weight of materials used is received in bags which are dumped into an air conveyor system in the warehouse proper, some 200 feet from the manufacturing floor. The conveyor system delivers the resin to a large hopper on top of a tower designed for compounding operations. From the hopper the resin is automatically fed to an enclosed sifter and then to an automatic scale that weighs the resin and dumps it through an enclosed chute into covered ribbon-blade blenders. Plasticizer is metered into the blenders at controlled temperatures, and the resultant blend is free flowing, but non-dusty. Small amounts of non-toxic powdered ingredients are sometimes added to the blenders at the same time as the plasticizer.

On the floor below the blenders is the mouth of the Banbury mixer over which is a recording scale hopper fed from the blenders by push-button control. When the correct amount of blend has been run into the scale hopper, the mouth of the Banbury is opened, and a solenoid operated valve permits the blend to flow from the scale hopper to the Banbury. While the blend is flowing, the plastic bags containing the color pastes, lead stabilizer pastes, and white pigments are dropped into the mixer by the operator. A small slot exhaust at the Banbury mouth draws 250 cubic feet per minute, but the process produces little dust. The plastic bags do not burst until they have fallen unto the Banbury cavity, and the bags are finally dissolved into the mix.



INHALATION CONCENTRATION
Air-Supplied Helmet

Explanation of Symbols in Illustrations

Figures below the Symbols Represent Lead Concentrations in Milligrams per Cubic Meter of Air

After mixing in the Banbury, the batch is dropped on to an enclosed, exhausted conveyor and carried to the warm-up mill. This mill has a canopy head with side curtains and is exhausted at the rate of 1,100 cubic feet per minute. Slabs of plastic are cut from the mill and delivered to the calender on a short belt conveyor. The rear end of the calender is completely enclosed and exhausted at the rate of 7,500 cubic feet per minute. An embossing machine running in tandem with the calender has a simple canopy hood with an exhaust of 1,400 cubic feet per minute to capture any vapors which may arise. After embossing, the film is rapidly cooled by a set of large cooling drums, trimmed, passed through a continuous recording gage, and then wound on paper cores and wrapped for shipment.

This plant has an experimental unit for the extrusion of vinyl film. The blending of compounds for this operation is similar to the process used for calendered film and is carried out in the same equipment. Instead of going into the Banbury mixer, the extrusion blends are dropped into a portable hopper which is rolled to a point above a warm-up mill and discharged through a chute on to this mill. Slabs cut from the stock on the mill are subsequently granulated in a rotating knife-type granulator, and the granules fed to an extruder. Since the extruder is being operated on an experimental basis only, and has not been set in its permanent position, it has not been equipped with any special exhaust ventilation system.

Atmospheric Lead Concentrations

The samples of atmospheric dust were collected on one-inch diameter No. 41 Whatman filter papers. Two filter papers were placed in a special holder, and the workroom air was sampled through the double thickness at the rate of one cubic foot per minute. The collected samples were sent to the laboratory for analysis; care was taken to prevent contamination from extraneous sources of lead.

A polarographic method of analysis was used to determine the amount of lead in the collected samples. The procedure[4] was based on the work of Feitch, Schrenk, and Brown[5] and Kolthoff and Matsuyama.[6] In outline, the method consisted of digesting the filter papers in concentrated nitric acid, evaporating to dryness, and then heating in a muffle furnace at 480° C. for 30 minutes. A polarogram of the lead residue with potassium chloride as the electrolyte was made, using a Sargent-Heyrovsky Polarograph Model XII. The polagraphic curves for the samples were compared with lead standards.

Atmospheric concentrations of lead are placed in two categories, depending on where the samples were collected:

(1) Inhalation Concentration—the concentration of atmospheric lead, expressed in milligrams of lead per cubic meter of air, sampled at the breathing zone of the worker while performing at least one cycle of his operation.

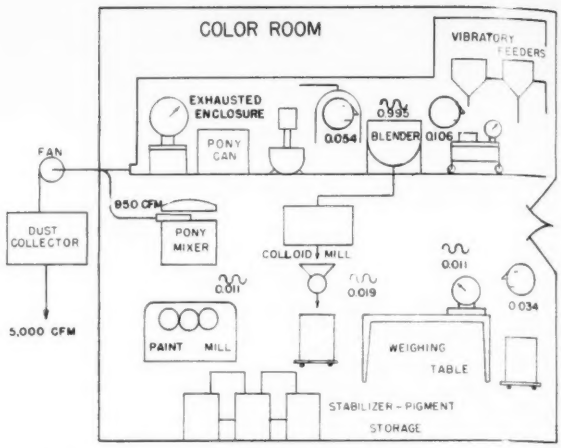


Fig. 1. Lead Concentrations at the Various Operations in the Color Room and Exhausted Enclosure for New Manufacturing Method

(2) Atmospheric Concentration—the concentration of lead in the workroom atmosphere, expressed in milligrams of lead per cubic meter of air, sampled at breathing level near the potential source of dust dissemination or center of work area for a period of 30 minutes.

The maximum allowable concentration of lead in the workroom atmosphere during an eight-hour period is 0.15-milligram of lead per cubic meter of air.[7] In evaluating an exposure to lead, it is important to correlate the atmospheric concentration with the duration of exposure. It can readily be seen from the data in Table 1, where the atmospheric concentrations of lead exceed the maximum allowable concentration for all operations, that the common method of production requires the wearing of an approved dust respirator. At the plant using the new method, the worker wears an air-supplied helmet during the transfer of the lead stabilizer to the blender, a total work period of only 20-30 minutes per day. This operation is done on only one of the three work shifts.

Results of tests of atmospheric and inhalation concentrations of lead with the new method are shown in Table 2 and graphically in Figures 1-3. Table 2 shows each individual operation, its duration, lead concentration, and type and amount of exhaust ventilation.

As shown by Table 2, the inhalation samples were below the maximum allowable concentration. The effective control attained in this plant is shown by the low concentrations of lead for all operations from the weighing of the ingredients to the finished product. The atmospheric concentrations were also below the maximum allowable concentrations except for the actual weighing of the lead stabilizer. This operation is controlled by the use of an air-supplied helmet. It is obvious that use of this new method of processing vinyl plastics results in maximum protection to the worker and in control of possible contamination of vinyl film which are to be used for food packaging.

[4] "Laboratory Manual," Bureau of Industrial Hygiene, Connecticut State Department of Health, Hartford, Conn. (1952).
[5] "Determination by the Dropping-Mercury-Electrode Procedure of Lead, Cadmium, and Zinc in Samples Collected in Industrial Hygiene Studies," F. L. Feicht, H. H. Schrenk, C. E. Brown. Publication R.I. 3639, Bureau of Mines, United States Department of the Interior, Pittsburgh, Pa. (1942).
[6] I. M. Kolthoff, G. Matsuyama, *Ind. Eng. Chem. (Anal. Ed.)*, 17, 615 (1945).
[7] "The Sanitary Code of the State of Connecticut," Connecticut State Department of Health, Hartford, Conn. (February, 1951).
"Threshold Limits," *Arch. Ind. Hygiene* & Occupational Medicine, 4, 398 (1951).

TABLE 2. CONCENTRATIONS OF LEAD AT PLANT USING NEW METHOD

Operation and/or Location	Duration of Operation per Shift Hours	Lead, Mg./Cu. Meter of Air	Type and Amount of Exhaust Ventilation
Inhalation Concentrations			
1. Inside air-supplied helmet during transfer of lead stabilizer to blender	0.5	0.054	Exhausted enclosure, 5,000 cfm.; worker uses air-supplied helmet
2. Weighing and sealing other lead compounds in plastic bags*	0.5	0.106	Exhausted enclosure, 5,000 cfm.
3. Weighing lead stabilizer mixed with plasticizer into plastic bags	1.0	0.034	None
4. Operation of steam-jacketed blender	8.0	0.016	None
5. Operation of Banbury mixer	8.0	0.009	Slot exhaust on feed hopper of Banbury, 250 cfm.
6. Operation of granulator	3.0	0.046	None
7. No. 1 warm-up mill	8.0	0.006	Canopy hood with side curtains, 1,100 cfm.
8. No. 2 warm-up mill	4.0	0.015	Canopy hood with side curtains, 1,600 cfm.
Atmospheric Concentrations			
9. Inside exhausted enclosure during transfer of lead stabilizer to blender	0.3	0.995	Exhausted enclosure, 5,000 cfm.
10. Vicinity of colloid mill	8.0	0.019	None
11. Vicinity of pony mixer in color room	8.0	0.011	Slot exhaust, 950 cfm.
12. Vicinity of weighing table	8.0	0.011	None
13. Resin weighing room	8.0	0.023	None
14. Steam - jacketed blender room	8.0	0.006	None
15. Vicinity of extrusion press	8.0	0.008	None
16. Vicinity of base of Banbury mixer	8.0	0.027	Exhausted conveyor, 1,000 cfm.
17. Vicinity of calendar and embossing rolls	8.0	0.006	Exhausted enclosure, 7,500 cfm.; canopy hood, 1,400 cfm.

*This operation was originally performed in the compounding tower with no exhaust ventilation. Under these conditions the atmospheric lead concentration was 5.700 mg./cubic meter of air. The worker used a dust respirator during the weighing period prior to the transfer of this operation to the exhausted enclosure.

Urinary Lead Concentrations

To assess further the degree of control obtained at this plant, samples of urine from the different workers exposed to the lead dust were quantitatively analyzed for lead content. The samples were collected on three consecutive work days, and the method of analysis used[7] was based on the work of Reed and Grant.[8]

The concentration of lead in the urine should be kept below 0.15-milligram of lead per liter of urine for workers exposed to lead compounds.[9] Urinary leads are not an indication of lead poisoning, but, if near or above 0.15-milligram per liter, indicate that the atmospheric concentrations of lead to which the worker is exposed are excessive. As shown in Table 3, all urinary lead concentrations in the new plant are well within the 0.15-milligram limit and are within or near the range for non-exposed individuals.

TABLE 3. URINARY LEAD CONCENTRATIONS OF EXPOSED WORKERS IN THE NEW PLANT

Operator	Urinary Lead, Concentration, Mg./Liter of Urine*
Supervisor of color room	0.03
Paint mill operator	0.04
Stabilizer and color weighers:	
Man #1	0.07
2	0.04
Banbury operator	0.02
Premix blender operator	0.08

*Urine adjusted to a specific gravity of 1.024.

The urinary leads are additional evidence that the

[7] *Ind. Med.*, 11, 107 (1942).
[9] "Occupational Lead Exposure and Lead Poisoning," American Public Health Association, New York, N. Y. (1943).

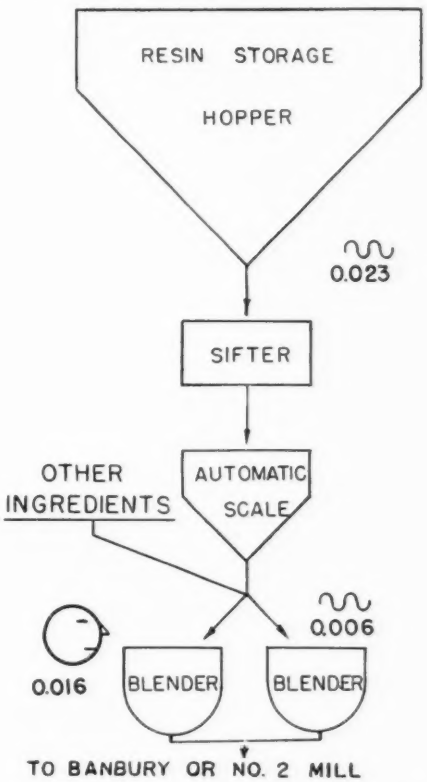


Fig. 2. Lead Concentrations at the Resin Storage Hopper and Blenders for New Manufacturing Method

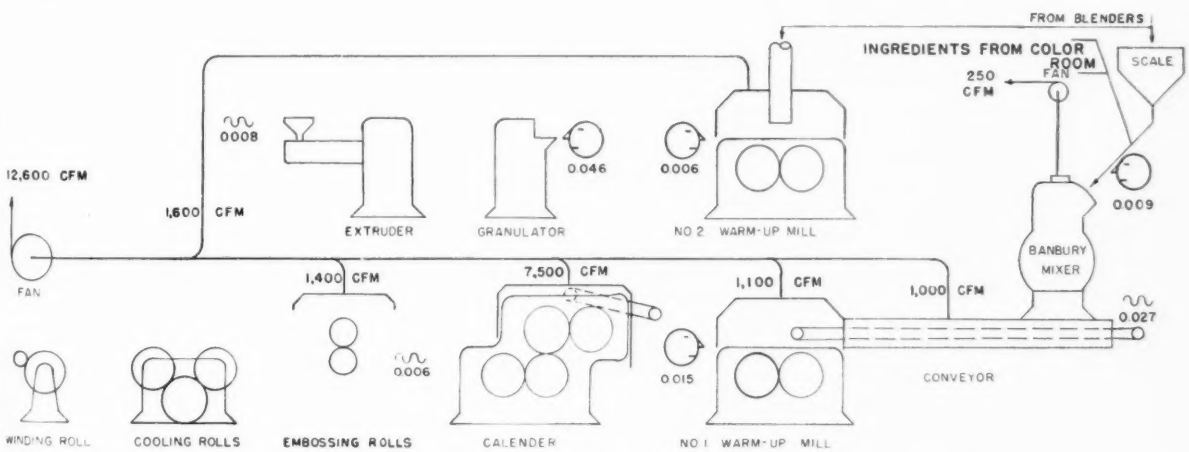


Fig. 3. Lead Concentrations at the Various Operations for Calendering and Extruding Vinyl Film in New Manufacturing Method

method used at this plant has resulted in the effective control of the lead dust hazard.

Summary and Conclusions

In the manufacture of plasticized polyvinyl chloride products the use of powdered lead compounds creates a definite health hazard that has been difficult to control effectively. A new method of manufacture provides the basis of maximum control of the dust hazard with a minimum of exhaust ventilation. Under this new method lead compounds and other powdered stabilizers, colors, and pigments are (1) transferred from their original containers in an exhausted enclosure; (2) either processed into non-dusty forms; or (3) weighed into plastic bags which are sealed before entering the factory proper. This innovation in the manufacture of vinyl products resulted in inhalation concentrations of lead in the workroom atmosphere that are well below the maximum allowable concentrations as defined by state regulations. The concentrations of lead in the urine of exposed workers were within or near the range for individuals not exposed to lead dusts.

Acknowledgments

The authors express their appreciation to Rudolph K. Waldman, Bureau of Laboratories, Connecticut State Department of Health, for making the urinary lead determinations.

We are especially thankful to Ross & Roberts, Inc., and the Bureau of Industrial Hygiene, Connecticut State Department of Health, for their permission to make this information available to the plastics industry.

Meetings and Reports

Record Attendance and Varied Program Feature SPE Conference

A RECORD total of 1,050 members and guests attended the ninth annual National Technical Conference of the Society of Plastics Engineers, Inc., held January 21-23 at the Hotel Statler, Boston, Mass. Marked interest was displayed in the technical program, which consisted of morning and afternoon sessions, at which 37 technical papers were presented. The meeting also included the Society's annual business meeting on January 21, the annual banquet on January 22, and the annual luncheon on January 23.

New National Officers Elected

The annual business meeting marked the official opening of the Conference and highlighted the announcement of the Society's new national officers for 1953, as elected by the national directors. The new officers are: president, Walter F. Oelman, Standard Molding Corp.; vice president, Stanley Bindman, Jamison Plastic Corp.; secretary, John W. LaBelle, Koppers Co., Inc.; and treasurer, Richard W. Bruce, Bakelite Co.

Reports were also heard from the outgoing president, William O. Bracken, Hercules Powder Co., the retiring treasurer, Don F. Hoffman, Evans-Winter-Hebb, Inc., and the chairmen of the various national committees. Executive Secretary Mrs. Bess R. Day announced her resignation from the post as of July 1, 1953.

Annual Banquet and Luncheon

The annual banquet featured a talk on spy activities during the past war by Countess Maria Pulaski, a quite unusual woman, the distribution of many door prizes, and an evening of dancing.

General G. F. Doriot, American Research & Development Corp., was guest speaker at the luncheon meeting. General Doriot described the impetus given to the plastics industry by the development and adoption of plastic products by the Armed Services during the war. The plastics industry has been fortunate, he said, in that it is young and flexible and was able to take its competitive industries by surprise. In the future, plastics can expect severe competition from these other industries, such as metals and wood. It must be recognized that plastics are not universal products and cannot be used for all applications, the speaker warned. Good plastics applications that will contribute to future growth of the industry can only come from engineering that considers the requirements of each application.

Further Abstracts of Papers

Abstracts of certain of the technical papers were given in our December issue, page 376, and the January issue, page 519. The remaining abstracts follow:

WEDNESDAY, JANUARY 21

The meeting began with a forum on **"Professional Training for the Plastics Industry,"** sponsored by the SPE education committee. This forum consisted of four talks, followed by an extensive open discussion period. The talks were **"Industrial Requirements for Plastics Engineers,"** R. C. Bartlett, National Varnished Products Corp.; **"Present Status of Plastics Education in the U. S. A.,"** C. C. Winding, Cornell University; **"Better Plastics Engineers for Industry,"** E. S. Bloom, E. I. du Pont de Nemours & Co., Inc.; and **"Future Training of Plastics Engineers,"** Bryce Maxwell, Princeton University.

Mr. Bartlett reported on a survey made to determine the need of professional engineers in the plastics industry. The survey showed that while 98% of the companies polled admit the need of professional engineers, the great majority of firms does not provide for further education or training of their personnel. Dr. Winding reported on a survey of plastics courses in colleges and universities which showed that nearly all such courses are electives; much of the laboratory work involved chemistry or materials, with few schools doing work on processing; and definite indications that plastics laboratory equipment for fabricating, processing, and testing are considered too expensive for installation except in special instances.

Dr. Bloom emphasized the need of better plastics engineers by the industry and called for renewed emphasis in education on process and flow characteristics, heat transfer, mold design, and fundamental properties of plastics. Mr. Maxwell reviewed the plastics education curriculum set up by the committee to insure proper training of engineers. This program has been in use at Princeton for seven years and is now being adopted by two other institutions.

"Specialty Plastics, Including Epoxy Casting Materials," Clinton Rector, National Engineering Products, Inc. Using slides and samples of products to illustrate his talk, the speaker discussed the specialty uses of plastics, such as phenolics in bonded brake linings, clutch facings, electrical resistors, and shell molds. The epoxy resins can be formulated to provide a wide range of properties from liquids to greases to solids, both rigid and flexible solids, both tacky and nontacky materials, and other variations in physical and electrical properties. Many of the uses for these casting materials are unique and cannot be duplicated by other materials.

Winning papers in the 1952 SPE Prize Paper Contest were announced at the session presided over by R. C. Davenport, Gregstrom Corp. The winning papers follow: first prize, "The Basic Principles of the Injection Molding Process," C. E. Beyer and R. B. Dahl, both of Dow Chemical Co.; second prize, "A New Process for the Manufacture of Furfuryl Alcohol Resin Intermediates," E. R. Nielson, Armour Research Foundation; third prize, "Injection Molding of Elastomeric Vinyl Materials," F. A. Martin, Hoover Co.; and honorable mention, "Compounding and Processing of Rigid Polyvinyl Chloride," R. J. Ettinger, B. F. Goodrich Chemical Co.

THURSDAY, JANUARY 22

"Polystyrene—25 Years of Progress," A. J. Warner, Federal Telecommunication Laboratories. The history, development, and current status of polystyrene were reviewed. This plastic has shown the greatest rate of growth of any material in history and among the plastics now rates sec-

Fay Foto Service, Inc.

New SPE National Officers for 1953: (*Left to Right*) Richard W. Bruce, Treasurer; Walter F. Oelman, President; Stanley Bindman, Vice President; and John W. LaBelle, Secretary

and only to the vinyls. The current slowdown in growth of polystyrene does not mark the limit of expansion, but is actually a breathing space and starting phase for future growth. The development of modified styrenes, which will be available in commercial quantities in the near future, will initiate the next phase of growth.

L. T. Raymond, Major Mold & Die Co., was unable to attend the Conference, and his paper on "Large Mold Construction" was read by John Andras, of the same company.

"The Vacuum Forming Picture," R. L. Butzko, Noma Electric Corp., and E. B. Stratton, Jr., Industrial Radiant Heat Co. In the first half of the talk, Mr. Butzko described the vacuum forming process and the equipment used, as well as its applications and products. It was emphasized that the major problem with equipment is to provide uniform heating over the whole large area of plastic sheet. In the second part of the talk, Mr. Stratton compared the relative advantages of vacuum forming and injection molding. While injection molding involves high tooling costs, long tooling periods, low production rates, and high piece costs, vacuum forming utilizes relatively cheap machines, cheap molds, and high production rates. A major advantage of the forming process is that sheets can be preprinted to reduce costs. The plastics industry can absorb some 300 vacuum forming machines a year, and forming presses capable of handling sheets 100 square feet in area are forecast within two years. Another development expected in the near future is continuous printing and forming from roll materials.

"Reinforced Polyesters for Aircraft," C. D. Birmingham, Colt's Mfg. Co. Polyester-Fiberglas laminates are used in all parts of modern aircraft as components, semi-structural parts, and structural parts. Many of these applications are not replacements, but are new designs utilizing the properties of these relatively new materials. Advantages of the reinforced polyesters include ability to make irregular contours, dimensional stability, relatively inexpensive tooling and production costs, and choice of molding methods. On the other hand, the lack of defined testing techniques does not permit exact prediction of production results.

The afternoon session also included an innovation in the program in the form of a research symposium conducted by Mr. Warner. This symposium consisted of three papers, abstracts of which follow:

"A Statistical Study of Extrusion Variables," R. E. Colwell, Monsanto Chemical Co. Recent contributions have been made to the fundamentals of an extrusion theory, but no general theory covers all the 10 pertinent variables associated with a plastics extruder. Results obtained from a plant-scale experiment extruding a vinyl material were interpreted with the aid of statistical techniques. Variables considered include screw design, screw speed, extrusion temperature, and material particle size, formulation, and temperature.

"The Flow of Plastics Melts through Dies," J. P. Tordella, du Pont. The types of flow encountered with viscous liquids were discussed, and the behavior of plastics melts related in a general way to their molecular constructions. Approximate flow equations were given for several types of extrusion dies, and the flow constants tabulated for a number of commercial plastics.

"Static Dust Collection of Plastics," E. E. Ziegler, Dow. By a new technique it is possible to blow a specially compounded fluorescent dust into a test chamber containing plastic specimens and obtain in a few minutes dust deposits which formerly took months to accumulate naturally. This technique has made it possible to explore the field of static charges on plastics and determine the effects of several variables on the dust deposits. Some of the better destaticizers for polystyrene now available include Arquad 18 and Joy and Glim household detergents. No good destaticizer is now known that will withstand water-washing of the plastic.

FRIDAY, JANUARY 23

"Multi-Screw Extrusion of Rigid Vinyls," S. H. Greenwood, F. J. Stokes Machine Co. The meshed multi-screw extruder has been found exceptionally well adapted for the extrusion of fully rigid PVC. Accurate control of the extruder elements is necessary for successful operation. These controls include temperature pyrometers for the barrel, die adapter, and die; screw speed; feed regulator; and variable speed motor control. Extruder design and operation were discussed, together with die design and take-off equipment.

"Electrostatic Properties of Rubber and Plastics," H. A. Endres and W. T. Van Orman, both of Goodyear Tire & Rubber Co. This paper reviewed the phenomenon of the accumulation of electrostatic charges in rubber and plastics, the hazards accompanying uncontrolled electrostatic discharge and means of controlling or dissipating the charges. A useful application of this property of certain plastics is utilized in the manufacture of self-charging electrostatic air filters.

The concluding afternoon session took the form of an open forum at which all the Conference speakers constituted the panel to answer questions from the floor.

Reports from Sections

New York-Newark Panel on Large Injection Molding

A panel discussion on "Large Injection Molding" featured the January 14 joint dinner-meeting of the New York and Newark sections, SPE, held at the Military Park Hotel, Newark, N. J. More than 175 members and guests attended the meeting, which included a cocktail hour, dinner, business session, and technical meeting.

R. H. Hoehn, Mack Molding Co., acted as moderator of the discussion, and the panel members were E. J. Csaszar, Eagle Tool & Machine Co., for the moldmakers; R. W. Barber, Panelyte Division, St. Regis Paper Co., for the molders; A. J. DeMatteo, Watson-Stillman Co., and Russ Powell, Hydraulic Press Mfg. Co., for the machinery manufacturers; and R. W. Van Sickle, Dow Chemical Co., for the material suppliers. Each of the panel member spoke briefly on some of the problems involved in making large injection moldings, and the meeting was then thrown open to questions from the floor.

Outgoing Newark President E. W. Rowan, Dillon-Beck Mfg. Co., welcomed the New York members to the meeting and introduced the new Newark president, Jack R. Pecktal, Eastman Chemical Products, Inc. Mr. Pecktal introduced the other new officers and directors of the Newark section as follows: vice president, E. K. Preston, Celluplastic Corp., secretary-treasurer, W. H. Willert, Frank W. Egan & Co., and directors, W. J. Trautweiler, Newark Die Co., Mr. Willert; D. W. Biklen, Orangeburg Mfg. Co.; and M. A. Sanders, Bloomfield Molding Co. Mr. Pecktal presented an inscribed watch to Mr. Rowan in token of the Section's appreciation for his services.

Newark committee chairmen for the coming year were also announced by Mr. Pecktal, as follows: membership, W. M. Preston, Koppers Co., Inc.; credentials, R. H. Hoehn, Mack Molding Co.; program, Mr. Biklen (to July 1) and E. B. Soules, Detroit Mold Engineering Co. (after July 1); house, R. M. Goldrick, Irvington Varnish & Insulator Co., and J. A. Herring, Naugatuck Chemical Division, United States Rubber Co.; publicity, Edward Ackerman; engineering societies council representative, Mr. Sanders; education, P. W. Simmons, Dow; and special activities, W. M. Schrag, Gering Products, Inc.

New York Section committee chairmen for 1953 were also announced by President Saul Blitz, Noma Electric Corp., as

(*Continued on page 680*)

Scientific and Technical Activities

New Hotel Statler Site of Division of Rubber Chemistry, A. C. S., Los Angeles, March 18, 19 Meeting

THE Division of Rubber Chemistry of the American Chemical Society will hold its sixty-second meeting at the new Hotel Statler in Los Angeles, Calif., on March 18 and 19, as a part of the one hundred twenty-third national meeting of the parent Society. S. G. Byam, E. I. du Pont de Nemours & Co., Inc., chairman of the Division, will preside at the opening session on the afternoon of March 18.

The meeting of the Division will comprise three technical sessions, the first on the afternoon of March 18, the second the morning of March 19, and the third on the afternoon of the same day. Twenty technical papers will be presented; those at the first session will be concerned mostly with rubber and other elastomers; the second session will place emphasis on chemical and physical test methods and also will include a paper on the recently reorganized and expanded program in rubber technology at the University of Southern California; and the final session will be devoted mostly to papers on carbon blacks, with a paper on powdered reclaim and one on the thermal conductivity of silicone rubber compounds also included.

R. E. Bitter, B. F. Goodrich Chemical Co., is chairman of the local committee on arrangements. Registration will take place on the morning of March 18, and an Old Timers' luncheon will be held at 12-noon of the same day. The regular banquet of the Division will be held at 7:00 p.m. on March 19. The banquet program does not include any speakers, but will consist entirely of a program on entertainment in the best tradition of the West Coast, according to Mr. Bitter.

Abstracts of the 20 papers scheduled for presentation, together with their authors and affiliations and the program in some detail, follow:

WEDNESDAY AFTERNOON—MARCH 18

2:00 p.m.—1. **Introductory Remarks. Seward G. Byam.**

2:10 p.m.—2. **Aging Characteristics of Crude Guayule Rubber. W. J. Gowans**[1] and F. E. Clark, Natural Rubber Research Station, United States Department of Agriculture, Salinas, Calif.

The aging characteristics of crude guayule rubber were investigated by means of an accelerated aging test based on volumetric oxygen absorption measurements. Different methods of processing guayule rubber were found to have significant effects upon the stability of the rubber.

Removal of the resinous constituents by acetone extraction greatly improves resistance to deterioration. Presence of a metal sequestering agent in the milling liquid during the process of recovering the rubber from the shrub is also effective in reducing the rate of oxygen absorption.

A total of 26 different antioxidants was tested as to their respective abilities to preserve both resinous and deresinated crude guayule rubbers. These antioxidants were added in 1% concentrations based on the weight of the rubber. Beta and alpha conidendrol, phenolic types of compounds obtained as by-products from the wood pulp and paper industry appeared to be the best antioxidants for both resinous and deresinated rubbers. AgeRite White (di-beta-naphthyl-para-phenylenediamine) is another excellent antioxidant.

Crude deresinated guayule rubber without added antioxidant does not age so well as does #1 Smoked Sheet and pale crepe crude *Hevea* rubbers, but shows superior aging qualities when 1% AgeRite White is added.

2:35 p.m.—3. **An Improved Method of Determining Rubber Hydrocarbon in Rubber-Bearing Plants.** J. W. Meeks, R. V. Crook, C. E. Pardo, Jr., **F. E. Clark**, Natural Rubber Research Station.

The conventional method of determining rubber hydrocarbon in rubber-bearing plant material consists of comminution of the tissue to pass a three-millimeter hammermill screen, followed by extraction with water, alcohol, and benzene, respectively. The benzene extract after evaporation is weighed as rubber hydrocarbon. The major disadvantages of the method are: (1) the method is time-consuming, requiring a minimum of three days to complete an analysis; (2) all the rubber is not extracted because the method of comminution does not rupture all the plant cells; and (3) the benzene extract may contain impurities and is susceptible to oxidation during the drying operation.

These disadvantages are overcome in the improved method described in this paper. Comminution is carried out by crushing through corrugated and smooth rolls so that essentially all the cells are ruptured, and complete extraction can be accomplished. Benzene extraction is carried out by shaking with gravel in a shaking machine and can be effected in as short a time as two minutes. The rubber hydrocarbon is determined by a bromination procedure previously described by Gowans and Clark.

Detailed procedures are given, and calculations of precision are made. Application of the method to several types and age classes of guayule shrub is shown.

2:55 p.m.—4. **Some Recent Developments in Polymerization of GR-S at Low Temperatures. L. H. Howland**, V. C. Neklutin, R. L. Provost, F. A. Mauger, Naugatuck Chemical Division, United States Rubber Co., Naugatuck, Conn.

Recent investigations by the authors in the field of low-temperature GR-S polymerization have resulted in several technical advances. Polymerizations employing all rosin soap emulsification at 41° F. have been successfully activated with the lower polyethylene polyamines, diethylene triamine, and triethylene tetramine. At 0° F., polymerizations activated with triethylene tetramine have been conducted in an emulsifier system composed of 85% disproportionated rosin soap and 15% fatty acid soap. Data were obtained concerning the effect of methanol as an anti-freeze in subfreezing polymerization recipes, and it is indicated that the methanol has a deleterious effect on polymer quality. Very fast 41° F. polymerization recipes were developed for use in reactors equipped with auxiliary cooling surface such as an external heat exchanger, and for continuous polymerization in tubular-type reactors. Pilot-plant trials of the externally cooled reaction system and the continuous tubular-type system are described. Short-stopping of cold polymerizations is also discussed.

3:20 p.m.—5. **Chemical Nature of Extenders and Their Standardization for Use in Oil-Extended Rubbers. Fritz S Rostler** and R. M. White, Golden Bear Oil Co., Oildale, Calif.

Development work and industrial utilization of oil-extended rubbers masterbatched in the latex stage have been retarded by lack of standardization of the extenders. This lack of standardization is primarily due to disagreement among workers in the field on the chemical nature of the extenders used and to the absence of uniform nomenclature. Discussions about assumed, but unproven, chemical structures and about work on composition of petroleum unrelated to rubber compounding have obscured the real issues which are (1) determination of components of extenders regulating their behavior in rubber, (2) definition of extenders on the basis of quantitatively determinable values and (3) selection of analytical methods suitable for control tests.

This paper is an attempt to summarize present-day knowledge of composition of extenders and to correlate and clarify the above-mentioned three issues in accord with facts proven by experiments and applicable to rubber compounding. Chemical nature of extenders is discussed on the basis of quantitative data on extenders and their components obtained by employing the previously discussed group analysis and elementary analysis, and it is shown that the chemical nature of extenders and their function are best understood by applying principles validated and proved by classic organic chemistry. Interdependence of the chemical nature of the extenders and their origin is shown by a chart following the manufacture of the extenders, giving comopsition of the starting materials and their fraction. It is concluded that standardization of extenders in oil-extended rubbers is attainable on the basis of correlation of quantitative analytical data with chemical nature only if it is indicative of behavior in rubber compounding.

3:45 p.m.—6. **High Styrene Resin Reinforcement of Hard Rubber Stocks. Harold S. Sell** and Robert J. McCutcheon, Goodyear Tire & Rubber Co., Akron, O

High styrene resins are well known for their hardening and stiffening action in soft rubber compounds. This same compounding principle has now been applied to hard rubber-type stocks with equal effectiveness. By employing the high

[1] Name in bold face is that of author presenting the paper at the meeting.

styrene resin to promote a portion of the hardening and stiffening action in the hard rubber compound, it is possible to compound high hardness stocks at lower sulfur contents, which in many cases exhibit impact strengths far in excess of those obtained with conventional hard rubber stocks. The paper presents basic studies made in a GR-S hard rubber stock, and covers ranges from 0 to 100 parts of reinforcing resin per 100 parts of rubber, and sulfur ranges from 16 to 35 parts of sulfur per 100 parts of rubber.

In addition to the property improvements noted above, the resin incorporation produced physical improvements, most notable of which was the marked reduction in surface "orange peel" effect on pieces cured from the resin-bearing stocks. Also of note were the improvements in processing and preforming due to the reduced nerve and shrinkage of the resin stocks, and the reduced tendency for charring in thick sections when the resin-reinforced stocks are used. Studies are also presented which show that good impact strength can be maintained in stocks of high pigment loading when the high styrene resin-lower sulfur type of hard rubber stock is used.

4:05 p.m.—7. **Modern Vulcanization Processes. H. A. Freeman.** Goodyear. An outline of some of the methods used at just one rubber company is enough to illustrate the intricacies of modern curing. Different types of rubber goods require different techniques in that final step in their manufacture—vulcanization. A review of 10 classes of products includes: (1) sheet rubber, (2) frothed rubber, (3) inflated rubber products, (4) belts, (5) heels, soles, and molded goods, (6) hose, (7) hard rubber, (8) fuel cells, and (9) tubes. General methods of tire curing are cited, but breadth of this field prevents detailed presentation. To these rubber products are specifically applied 26 distinctly different methods of vulcanization. For example, the cure of frothed rubber is accomplished by (a) steam jet tunnel, (b) boiling water, or (c) electronic high frequency. Belts are cured (a) in long platen press with "cold ends," (b) rotocure, (c) wrap cure, or (d) reverse cure. A brief résumé of each process stresses its distinctive feature in this parade of modern curing.

4:30 p.m.—8. **Variables in the Compounding of Resin Acid-Rubber Masterbatches.** J. F. Svetlik and **R. S. Hanmer,** Phillips Petroleum Co., Bartlesville, Okla. Variations in the oxide loadings of rubber compounds made from resin acid-rubber masterbatches show that optimum properties can be obtained at or near the stoichiometric equivalent point of the saturalization of the resin acid by the oxide. There are indications that considerably higher amounts of resin acid than originally thought possible can be tolerated in these masterbatches if high loadings of oxide are employed. Blooming of the resin acid in cured vulcanizates, a considerable problem when conventional quantities of oxide are employed, can be minimized by using higher loadings of oxide.

Thursday Morning—March 19

9:00 a.m.—9. **Derivatives of Chlorosulfonated Polyethylene and Their Infrared Spectra. M. A. Smook,** E. T. Pieski, and C. F. Hammer, du Pont.

The chemical reactions which take place during the vulcanization of most elastomers have never been completely understood. Vulcanization is a complex process and the large number of reactive sites in the common elastomers encourages side reactions in addition to cross-linking. Chlorosulfonated polyethylene has comparatively few reactive sites, and it was hoped that infrared techniques would provide a method of following the reactions of the material.

Through the synthesis of model compounds and the identifications of their infrared bands, band assignments have been made for the aliphatic sulfonyl chloride group. The reactions of chlorosulfonated polyethylene with amines, alcohols, and inorganic bases have been followed by means of infrared. The sensitivity of the molecule to water during these reactions was demonstrated, and the effect of heat on the stability of the sulfonyl chloride group was shown. A clear picture of the mechanism of some of the cross-linking reactions of chlorosulfonated polyethylene can be obtained from this work. In addition, infrared band assignments have been made for the first time for a number of derivatives of aliphatic sulfonic acids.

9:25 a.m.—10. **Chemical Resistance of Chlorosulfonated Polyethylene. R. T. Currin,** du Pont.

Chlorosulfonated polyethylene offers exceptional resistance to chemical and solvent action, to the effects of oxidizing agents, and to absorption of liquids. The complete chemical saturation of chlorosulfonated polyethylene along with its chlorine content has given a polymer demonstrated to have outstanding resistance to ozone and oxygen. Because of this resistance the elastomer was expected to be relatively inert to most chemical attack.

Tests reported in this paper were limited to classes of chemicals known to be severe in their action on elastomers. Chemicals used included strong oxidizing acids, concentrated mineral acids, refrigerants, and oils. In strong oxidizing media chlorosulfonated polyethylene maintained an excellent surface and good tensile properties. Chlorosulfonated polyethylene even maintained its flexibility without increasing in stiffness after exposure to concentrated mineral acids.

The effects of compounding variables on chlorosulfonated polyethylene were studied. In general, the type and the amount of filler did not change the chemical resistance; however, the curing system proved important. Chemical attack on elastomers is aggravated at higher temperatures, and this effect of temperature on chlorosulfonated polyethylene is discussed. The improved chemical resistance of blends of chlorosulfonated polyethylene with other elastomers is also discussed.

9:50 a.m.—11. **Statistical Methods in Compounding Chlorosulfonated Polyethylene. W. L. Gore,** du Pont.

Experiments in rubber compounding are unusually complex, and a very large number of experimental combinations is often explored in the investigation of new formulations. This number can be reduced materially by applying modern scientific methods in designing the experiments. The relations between the conventional designs, the factorial, and the Latin Square are explained. An example is given of a half replicate factorial design used in exploring the cure system of a blend of chlorosulfonated polyethylene with natural rubber. In this example the number of experiments was reduced from 54 in. the original plan to eight in the half replicate factorial.

10:10 a.m.—12. **Influence of Various Weathering Factors on Ozone Cracking of Natural and Synthetic Rubbers. W. G. Mayes.** Firestone Tire & Rubber Co., Akron.

A study has been made of the relation between the depth of ozone attack and such variables as (1) ozone exposure temperature, (2) type of rubber compound, (3) type and extent of elongation, (4) wax content of the stock, (5) ozone concentration, (6) time of ozone exposure, (7) the amount of light during ozone exposure, and (8) state of cure.

In a comparison of the ozone resistivities of compounds based on several commercial polymers, the following order of decreasing resistivity was found: (1) butyl rubber, (2) neoprene, (3) Butaprene NSP-98, (4) *Hevea*, and (5) GR-S. This order of resistivity was found to hold over the temperature range of —20 to +60° C.

In a study of the influence of ozone exposure temperature on the depth of ozone attack (at an ozone concentration of 25 pphm) it was found that, in the range from —20 to +60° C. the most severe ozone attack took place at 40° C.

The presence of 2% wax in *Hevea* or GR-S was found to afford no protection against ozone attack at temperatures of 40° C. or higher, presumably because the wax becomes soluble in the compound at these temperatures. Light was found to decrease the extent of ozone attack on a compound under either static or dynamic elongation.

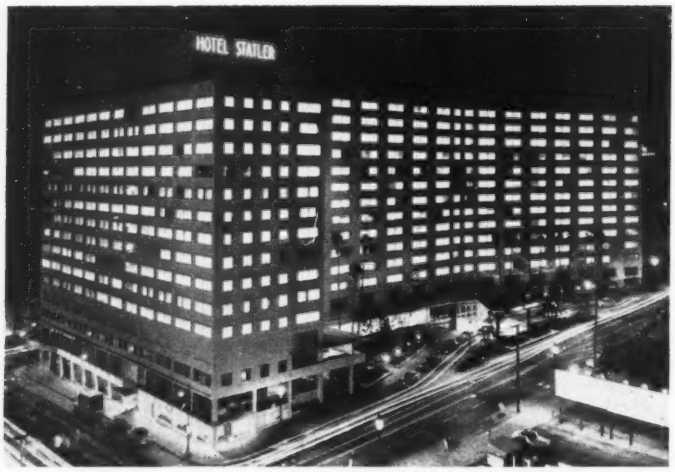
Depth of ozone attack is a minimum at optimum cure. Ozone attack and the molecular weight between cross-links were found to be linearly related—the lower the molecular weight between cross-links, the shallower the ozone cracks.

10:35 a.m.—13. **Ozone Formation in the Photochemical Oxidation of Organic Substances. A. J. Haagen-Smit** and C. E. Bradley, California Institute of Technology, Pasadena, Calif., and M. M. Fox, Los Angeles County Air Pollution Control District, Los Angeles.

Concentrations of ozone have been measured in the Los Angeles area which are ten times higher than those found normally. Ozone formation through the photochemical dissociation of nitrogen oxides is greatly enhanced by the presence of small amounts of hydrocarbons and their oxidation products. It is postulated that peroxide radicals are formed in the photochemical oxidation of these substances with nitrogen oxides, which then react with molecular oxygen to form ozone.

Substances such as biacetyl, bibutyryl, and pyruvic acid, which readily form radicals upon irradiation with sunlight, yield ozone in the absence of nitrogen oxides. The ozone formed was identified by chemical and physiological methods.

Since the concentrations of nitrogen oxides and hydrocarbons used in these experiments are similar to those found in the Los Angeles area, the occurrence of abnormally high ozone concentrations is readily explained. The high ozone concentration and excessive rubber cracking observed in this area is therefore caused by the same agents which are responsible for crop damage, eye irritation, haze and smell: namely, nitrogen oxides and hydrocarbons and their oxidation products.



Scene of the Rubber Division Convention in March in Los Angeles

These findings should be considered in planning rubber storage facilities.

Since the concentration of ozone formed in this manner is several times higher than the limit of 0.1 p.p.m. set by the Council of Physical Therapy of the American Medical Association for safe working conditions, the uncontrolled release of these chemicals should receive serious consideration.

11:00 a.m.—14. **The Structure of Neoprene. VI. Crystallization. J. T. Maynard** and W. E. Mochel, du Pont.

A volume dilatometric study of the crystallization behavior of neoprenes made at —40, 10, and 40° C. has shown that the melting point of the crystalline phase in these polymers is an inverse linear function of polymerization temperature. Polychloroprene made at —40° C. melts at ca. 65° C.; while conventional 40° C. neoprenes melt at ca. 40° C. Comparison of these data with the melting point depression observed in a chloroprene-methacrylonitrile copolymer and in polychloroprene-diluent mixtures has made possible calculations which confirm earlier hypotheses that neoprenes have a highly regular structure. Commercial neoprenes made at 40° C. are calculated to consist of 80-85% of the *trans*-2-chloro-2 butenylene units which result from *trans*-1,4 polymerization of chloroprene.

Densities determined for crystalline and amorphous neoprenes have been used to calculate the degree of crystallinity of these polymers, and this information has made possible calibration of the infrared crystallization-sensitive bands, for use in measurement of degree of crystallinity. The heat of fusion of the crystalline phase of neoprenes has been found from diluent data to be 22.7± 2 calories per gram.

11:30 a.m.—15. **Program in Rubber Technology at the University of Southern California. Robert E. Vivian** and Joseph S. Smatko, University of Southern California, Los Angeles.

Since 1934 the chemical engineering department of the University of Southern California has been offering courses in rubber technology in the evening for men from the local rubber industry. During World War II the university expanded these courses to train many chemists for the new synthetic rubber plants being built in the Los Angeles area.

The Los Angeles Rubber Group, Inc., recently decided to support the establishment of a complete program in rubber technology on the campus of the university, and it has raised a fund of $100,000 for this purpose. Equipment for a modern rubber laboratory is being secured and installed. Dr. Harry L. Fisher has agreed to become the first director of the program, assuming this position February 1, 1953.

Dr. David Spence has donated his valuable library of periodicals and books on rubber to the university. It includes several rare first editions. In addition, he has given $5,000 for the maintenance and expansion of the library collection.

Two undergraduate courses in rubber technology were offered last semester, and they are being given now, including one graduate course by Dr. Fisher. The laboratory courses will begin next fall, when the equipment will be ready. It is planned to offer the work largely in the evening for men from the rubber industry as well as for the regular daytime students in chemical engineering and chemistry who wish to enter the rubber industry.

Plans have been made for a degree of Bachelor of Engineering, with a major in Chemical Engineering (Rubber Option) and for a graduate program of education and research for the degree of Master of Science. These plans are being developed in cooperation with the education committee of Tlargi, in the endeavor to help meet the needs of highly qualified technical men by the growing rubber industry in the West.

Thursday Afternoon—March 19

2:00 p.m.—16. **Powdered Reclaim. D. S. le Beau,** Midwest Rubber Reclaiming Co., East St Louis, Ill.

Laboratory data on a new kind of reclaim produced in powder form, free flowing and suitable for automatic handling, will be discussed. A variety of these reclaim powders can be produced. They are usually, but not necessarily, prepared in premix form. They will produce pliable coherent sheets immediately when subjected to mastication.

The present paper will discuss in greater detail some of these reclaim powders, in particular those containing carbon black. Analytical data seem to indicate that carbon black, when present, becomes adsorbed on the surface of the individual reclaim particle and is held there tightly afterward. This action takes place during the actual reclaiming process and results in effect in a predispersion of the carbon black. Coherent and pliable sheets are obtained from such reclaim powders, even of the added carbon black amounts to as much as 35% of the weight of the sheet. This predispersion seems to aid in processing and also seems reflected in the physical data of compounds prepared by use of reclaim powders.

Data obtained from a laboratory type Banbury show that mixing cycles can be shortened and batch sizes can be increased, depending on the amount of reclaim powder used in the compound. Data on power consumption will be presented, and data on the physical properties before and after aging, as well as chemical analyses, will be discussed.

The process permits the production of reclaim within a very wide range of plasticities, much wider than that possible by the use of conventional reclaiming equipment.

2:25 p.m.—17. **A Simple Flexibility Test. Dietrich G. Stechert,** Gates Rubber Co., Denver, Colo.

For some time there has been a need of a flexibility test which is simple, but at the same time meaningful, for rubber and plastic products. Numerous tests have been proposed in the past. These include simple beam and cantilever type tests and various modifications. Generally these are considered to be small deflection tests.

The flexibility of rubber and plastic products depends on the curvature to which they are bent. If the flexibility of belting or hose, for example, is needed for design or development purposes, it should be measured at the desired degree of curvature.

The proposed test consists of the measurement of a distance and a force, using a simple, inexpensive piece of equipment, which can be home-made. A quick calculation yields the flexural rigidity, a standard measure of flexibility in the study of the strength of materials. Although the test equipment is simple, the test is sensitive to small variations in flexibility.

Because of the extreme simplicity of equipment, technique, and calculation of flexural rigidity, it is suggested that the test be used wherever a quantitative measurment of the flexibility of rubbber products or test pieces is needed. Thus the method may be useful in research, development, design, and control work.

2:45 p.m.—18. **Chemistry in Carbon Black Dispersion. Bernard C. Barton** and George H. Ganzhorn, U. S. Rubber, Passaic, N. J.

Heating rubber-carbon black mixtures at elevated temperatures results in vulcanizates with lower electrical conductivity, lower hysteresis, and lower durometer hardness. These changes are apparently the result of chemical reactions between carbon black and rubber which alter the dispersion of the carbon black. Data presented show that the basic factors effecting these changes are the chemical reactivities of the carbon black and the polymer and the time and temperature of treatment.

Maximum wear resistance is obtained only in stocks highly reinforced with carbon black of small particle size (15-40 μ). It is generally accepted that high hysteresis, relatively high durometer hardness, and increased electrical conductivity are associated with this reinforcement. Experi-

mental evidence is presented which indicates that these physical properties can be changed more by the physical nature of the dispersion resulting from chemical reaction of black with rubber than by the physical properties of the individual particles of black. It will be shown that these changes can be made without affecting the so-called reinforcing properties of the black.

3:10 p.m.—19. **The Ultimate Analyses of Carbon Blacks. I. Merton Studebaker,** Phillips Chemical Co., Akron.

Very little accurate data are available in the literature on the ultimate analyses of carbon blacks. This paper presents analyses of a number of current commercial samples. It is shown that the various types of carbon black have characteristic analyses. The relation among oxygen content, hydrogen content, and surface area of various types of carbon black is discussed. A few properties of carbon blacks, which can be related to the ultimate analyses, are treated briefly.

3:30 p.m.—20. **II. Merton Studebaker.**

When carbon black is incorporated into rubber, the physical properties of the loaded stocks are dependent upon the type of carbon black used. In the first paper of this series it was pointed out that the various types of carbon black are characterized by their ultimate composition (and other properties). The following rubber properties are treated with respect to the influence of oxygen content and hydrogen content of the carbon black used: modulus, Mooney viscosity, resistivity, and road-wear.

3:50 p.m.—21. **The Effect of Temperature on Thermal Conductivity Coefficient of Silicone Rubber Compounds.** M. G. Etzwiler, R. M. Combs, **T. J. Sobol,** Connecticut Hard Rubber Co., New Haven, Conn.

The thermal conductivity coefficients of silicone rubber and other materials have been measured at various temperatures in the range of —65 to +350° F. Other materials examined include polychlorofluoroethylene, polytetrafluoroethylene, and polychloroprene compounds. Materials studied were in the form of supported and unsupported films as well as molded sheets. The authors have included in this work the effect of oven aging on the thermal conductivity coefficient of the materials studied.

Thermal conductivity coefficients were measured by means of apparatus constructed to National Research Council specifications as modified by the University of Minnesota. Tests were performed in accordance with ASTM Standard Method C-177-45 and were conducted at the laboratories of Connecticut Hard Rubber Co.

GR-S Bound Styrene Content

IN ORDER to increase the total quantity of GR-S produced in the copolymer plants, the Office of Synthetic Rubber, RFC, announced that, effective January 1, certain cold GR-S polymers would be produced to a bound styrene content of 23.5+1%, instead of the former 20+1%. This change affects only GR-S-1500, -1501, -1502, -1600, and -1601 and does not affect the oil-extended polymers and the arctic polymers GR-S-1504 and -1505.

New Synthetic Hard Rubber Available

ACE TEMPRON, a new synthetic hard rubber compound based on nitrile rubber, and suitable for sustained high-temperature service with corrosive chemicals, has been announced by American Hard Rubber Co., New York, N. Y. Consisting of a group of compounds which can be altered to provide the combination of properties needed for a specific application, Tempron is a thermosetting material claimed to provide greater rigidity, heat resistance, and chemical resistance than that given by previously available hard and soft nitrile rubber compounds.

At present Tempron is available in the following four forms: (1) pipe and fittings; (2) molded parts with unlimited design possibilities; (3) sheet, rod, and tube stocks for further machining or fabrication; and (4) a hand-fabricating process for making tanks, large fittings, and similar parts by forming sheets prior to vulcanization. Tempron is compression molded by the use of hard rubber vulcanization techniques. Machinability is good, but carbide tools are recommended for longer tool life.

Physical and electrical properties of the material follow:

Tensile strength, psi	7,170–7,500
Elongation, %	2.70–2.80
Specific gravity	1.24–1.25
Hardness, durometer "D"	87
Impact strength, ft. lbs./in.	0.41–0.49
Flexural strength, psi	11,300–11,800
Water absorption (48 hrs. at room temp.), %	0.12
Heat distortion temp., °F	260–275
Dielectric strength (60 cycles), volts/mil	400–460
Power factor at one Kc.	0.016
Dielectric constant at one Kc.	3.50–3.70
Surface resistivity, megohms	$2.0–20\times10^3$

In chemical resistance at elevated temperatures, Tempron is claimed to excell generally other rubbers and plastics. At room temperatures it resists nearly as many inorganic corrosives as natural hard rubber and, in addition, is resistant to aliphatic hydrocarbons, solvents, oils, and many other organic chemicals that attack rubbers and plastics. It is not recommended for use with sodium hypochlorite or strong oxidizing agents such as nitric acid.

Process for Impregnating Leather with Butyl

THE process for impregnating leather with natural rubber, developed by the National Bureau of Standards in 1949, has recently been extended to permit use of polyisobutylene as the impregnant. Soles impregnated with this butyl polymer have the same greatly improved abrasion and water resistance as those containing natural rubber. Polyisobutylene, however, has a distant advantage over rubber in that it eliminates the milling operation required for the latter, with resultant savings in time, labor, and materials.

The butyl impregnation process was developed by Rene Oehler, Sverre Dahl, and T. J. Kilduff, of the Bureau's leather laboratory, and requires soaking of the naturally porous leather in a solution of the polymer. This solution is prepared by dissolving polyisobutylene having a molecular weight range of 50,000-100,000 in common solvents such as gasoline, kerosene, benzene, or chloroform. The leather is air dried and immersed in the solution for about three hours, after which operations excess solvent is wiped off, and the remaining solvent evaporated.

Use of vegetable tanned crust leather whose grain or hair side is split off to a depth of about 40 mils before impregnation results in a product suitable for use in luggage, upholstery, bookbinding, and other fine leather applications. NBS studies have shown the butyl polymer to be well suited for treating shoe soles and upper leathers because it reduces water absorption by about half and doubles abrasion resistance. Research in materials and techniques for leather impregnation is continuing at the Bureau, and pilot plant studies of butyl impregnation processes are being carried out under the sponsorship of the Navy Department.

More on Group Parties

SORG Has Gala Affair

THE sixth annual winter meeting of the Southern Ohio Rubber Group was held December 13 at the Miami Valley Golf Club, Dayton, O., with 284 members and their wives attending. The program included a filet mignon dinner, distribution of 88 door prizes, entertainment, and a card party and evening of dancing. Favors in the form of plastic travel kits were given to each lady present. All arrangements, except for the welcome absence of snow, were handled by a committee composed of E. N. Cunningham, Precision Rubber Products Co.; Dick Hempelman; H. M. Brubaker, Sid Richardson Carbon Co.; J. W. Shrontz, Harwick Standard Chemical Co.; D. A. Meyer, Dayton Rubber Co.; Joe Holmes; R. E. Kraus, Inland Mfg. Division, General Motors Corp.; W. J. Bolin, American Zinc Sales Co.; and R. B. Appleby, E. I. du Pont de Nemours & Co., Inc.

New officers and directors of the Group for the coming year were announced, as follows: chairman, George E. Lang, Johnson Rubber Co.; chairman-elect, Stewart L. Brams, Dayton Chemical Products Laboratories Co.; treasurer, William L. Nolan, Inland; secretary, Russell J. Hoskin, Inland; and directors, (three years) D. R. Buchanan, Inland; Frank Newton, Dayton Rubber, and E. L. Stangor, du Pont; (two years) J. Poffenberger, Cincinnati Rubber Mfg. Co., and Messrs. Brubaker and Nolan, and (one year) R. B. Hickernell, Inland; William Whittaker, Herron Bros. & Meyer, Inc., and Mr. Appleby.

New Officers Inducted

THE Northern California Rubber Group held its twelfth annual Christmas party on December 4 at the Villa Lorenzo, San Lorenzo, Calif. The affair was attended by some 140 members and their wives, who enjoyed a dinner and evening of dancing. Each lady in attendance received a gift through the contributions of local rubber and supplier companies. Arrangements for the party were handled by a committee under the chairmanship of William Moser, Pacific Tire & Rubber Co., and including Miss Ruth Hatch and Ted Liljenwal, both of Pacific Tire, Grover Ramsey, Grove Controls Co., and D. C. Maddy, Harwick Standard Chemical Co.

New officers of the Group for 1953 were installed as follows: president, J. Hollis-

ter, Mare Island Naval Rubber Laboratory; vice president, Mr. Moser; secretary, Halsey Burke, Burke Rubber Co.; and treasurer, Gene Gador, Oliver Tire & Rubber Co. The outgoing officers were presented with gifts by the Group in appreciation of their efforts during the past year.

Detroit Group Holds Election

MORE than 550 members and guests of the Detroit Rubber & Plastics Group attended the annual Christmas party on December 12 at the Sheraton Cadillac Hotel, Detroit, Mich. Highlight of the affair was the entertainment program which featured a hypnotist, one of whose subjects was Program Chairman W. F. Bauer, Brown Rubber Co. Educational Chairman V. H. Vodra, Wyandotte Chemicals Corp., announced that courses in rubber compounding will be given at Wayne University starting in February.

Election of officers and chairmen for the coming year took place, and the slate selected by the nominating committee was unanimously approved, as follows: chairman, E. V. Hindle, United States Rubber Co.; vice chairman, W. J. Simpson, Chrysler Corp.; secretary, Mr. Bauer; assistant secretary, E. W. Tillitson, Wayne University; treasurer, J. T. O'Reilly, Ford Motor Co.; assistant treasurer, H. W. Neale, Pioneer Latex & Chemical Co.; program chairman, J. B. Ledden, E. I. du Pont de Nemours & Co.; Inc., assisted by H. F. Jacober, Baldwin Rubber Co.; publicity chairman, J. B. Craft, General Tire & Rubber Co., assisted by Don Koza, Automotive Rubber Co., Inc.; entertainment chairman, R. C. Chilton, Permalastic Products Co., assisted by H. Wiles, General Motors Corp.; educational chairman, Mr. Vodra, assisted by E. J. Kvet, Detroit Tank Arsenal; membership chairman, H. W. Hoerauf, U. S. Rubber, assisted by W. Wiard, Dow Corning Corp.; historian, T. W. Halloran, Chemical Products, Inc.; and counselors, G. M. Wolfe, Sharples Chemicals, Inc., and G. T. Lindner and G. P. Hollingsworth, both of Minnesota Mining & Mfg. Co.

Tlargi Has Gala Affair

THE Christmas party of The Los Angeles Rubber Group, Inc., held in the new Hotel Statler, Los Angeles, Calif., December 12, was enjoyed by 626 members and guests. Each of the ladies present received a white gardenia and two pairs of hose as table favors.

R. E. Vivian, dean of engineering, University of Southern California, gave a report on the program of the Rubber Technology Foundation at the University, sponsored by the Group.

R. D. Abbott, consultant, chairman of the nominating committee, introduced the new officers for 1953, as follows: chairman, D. C. Maddy, Harwick Standard Chemical Co.; associate chairman, D. E. Budnick, Kirkhill Rubber Co.; vice chairman, F. C. Johnston, Caram Mfg. Co.; secretary, Carl S. Hoglund, Goodyear Tire & Rubber Co.; treasurer, Roy N. Phelan, Atlas Sponge Rubber Co.; and directors, Al Federico, C. P. Hall Co. of California; D. M. Sheppard, Goodyear; R. L. Short, Kirkhill; and Tommy Thompson.

Life membership certificates were presented by Chairman Bob Short to the following, for their outstanding contributions to Tlargi: A. L. Pickard, Braun Corp.; Chas. J. Roese; and Curtis Wolter, Witco Chemical Co.

Mr. Budnick, chairman of the Christmas party committee, and his committee consisting of W. A. Fairclough, Enjay Co.; Mr. Hoglund; Ted Kyle, Plastic & Rubber Products Co.; Bill Snyder, R. T. Vanderbilt Co.; and Mr. Federico, were congratulated on the success of this excellent party.

Lee-Tex Products Co. donated Christmas balloons. Twenty lucky women guests received valuable door prizes.

CALENDAR

Feb.	18.	Washington Rubber Group. New York Section, SPE. Hotel Gotham, New York, N. Y.
Feb.	18-20.	SPI Reinforced Plastics Division. Shoreham Hotel, Washington, D. C.
Mar.	1-31.	American National Red Cross. Annual Campaign for Funds.
Mar.	2-6.	ASTM. Spring Meeting. Detroit, Mich.
Mar.	5.	Northern California Rubber Group.
Mar.	10-11.	Society of Plastics Industry (Canada), Ltd. Eleventh Annual Conference. General Brock Hotel, Niagara Falls, Ont., Canada.
Mar.	11.	Newark Section, SPE. Military Park Hotel, Newark, N. J.
Mar.	17.	Elastomer & Plastics Group, Northeastern Section, A. C. S.
Mar.	18.	Washington Rubber Group. New York Section, SPE. Hotel Gotham, New York, N. Y.
Mar.	15-20.	American Chemical Society, Los Angeles, Calif.
Mar.	16-18.	National Assn. of Waste Material Dealers, Inc. Fortieth Annual Convention. Conrad Hilton Hotel, Chicago, Ill.
Mar.	18-20.	Division of Rubber Chemistry, A. C. S. Hotel Statler, Los Angeles, Calif.
Mar.	20.	Boston Rubber Group.
Mar.	23-25.	Committee D-20, ASTM. Pocono Manor, Pa.
Mar.	27.	Chicago Rubber Group. Morrison Hotel, Chicago, Ill. Akron Rubber Group. Mayflower Hotel, Akron, O.
Apr.	7.	The Los Angeles Rubber Group, Inc. Hotel Statler, Los Angeles, Calif.
Apr.	8.	Newark Section, SPE. Military Park Hotel, Newark, N. J.
Apr.	8-10.	SPI Pacific Coast Section Conference. Last Frontier Hotel, Las Vegas, Nev.
Apr.	9.	Northern California Rubber Group. Elastomer & Plastics Group, Northeastern Section, A. C. S.
Apr.	10.	New York Rubber Group. Henry Hudson Hotel, New York, N. Y.
Apr.	15.	Washington Rubber Group. New York Section, SPE. Hotel Gotham, New York, N. Y.
Apr.	20.	American Management Assn. Packaging Conference & Exposition, Navy Pier, Chicago, Ill.
Apr.	21.	Assn. of Consulting Chemists & Chemical Engineers, Inc. Symposium and Dinner. Hotel Belmont Plaza, New York, N. Y.
Apr.	28-30.	Rubber & Plastics Division, ASME. Columbus, O.
May	5.	The Los Angeles Rubber Group, Inc. Hotel Statler, Los Angeles, Calif.
May	7.	Northern California Rubber Group.
May	9-15.	SPI. Annual Meeting and Conference. Cruise on "Queen of Bermuda."
May	13.	Newark Section, SPE. Military Park Hotel, Newark, N. J.
May	19.	Elastomer & Plastics Group, Northeastern Section, A. C. S.
May	20.	Washington Rubber Group. New York Section, SPE. Hotel Gotham, New York, N. Y.

Public Relations for Chemists

A SYMPOSIUM on the subject of "Public Relations for Chemists" was held by the American Institute of Chemists' New York Chapter and the American Chemical Society's New York Section at the Hotel Commodore, New York, N. Y., January 15.

Walter J. Murphy, editor, *Chemical Engineering News*, presided at the morning and afternoon sessions.

Robert L. Taylor, vice president, Hill & Knowlton, Inc., first discussed "Why Public Relations for Chemists" and emphasized the need of teamwork among the chemists, his associates, and the public.

Henry B. Hass, president, The Sugar Research Foundation, Inc., talked on "The Chemist and His Profession" and, after reviewing the many characteristics of chemists that have both helped and hindered him in his relations with others, concluded that never before have public relations been so vital to the chemist, and this aspect of his professional life seems certain to increase in importance in the forseeable future

Emil Ott, director of research, Hercules Powder Co., discussed "The Responsibilities of the Chemist to His Country." Dr. Ott emphasized that the chemist's responsibility to his country does not end when his laboratory work is done—he must make sure his countrymen understand the significance of that work.

Raymond E. Kirk, dean, graduate school, Polytechnic Institute of Brooklyn, in his talk "Don't Be a Stillborn Chemist," said that every chemist must accept the personal responsibility for continuing his education and that this means continued study, continued thought, and continuous reading.

George F. Rugar, assistant manager, technical service division, Diamond Alkali Co., discussed "The Chemist and His Industry"; while Robert B. Semple, president, Wyandotte Chemical Co., talked on "Industry and Its Chemists." Mr. Semple pointed out that industry, to its neighbors, its customers, its shareholders, and its workers, is much more than a local source of revenue, a supplier, a dividend check, or a pay voucher. It is the shadow of a man, a group of men, and as this man, or these men do; so does industry; and as they are regarded; so is industry.

The final speaker was J. C. Warner, president, Carnegie Institute of Technology, who dealt with "The Professor and His Public." It is the college professors right—and indeed his duty—to speak out on public issues but he must know what he is talking about, and he must not claim "academic immunity" for what he says, Dr. Warner pointed out. He concluded his talk with a plea for a more positive effort from professors to understand the achievements of business and industry.

NEWS of the MONTH

With the engineering appraisal report of the government's synthetic rubber plants due February 1 and the report of the Reconstruction Finance Corp. to the President and Congress due on March 1, jurisdiction over rubber matters in the new Congress, particularly in the Senate, may become a contest between John Bricker (Rep. Ohio), of the banking committee, and Lyndon B. Johnson, (Dem. Tex.), a member of the Armed Services committee.

The budget of the United State Government presented to Congress on January 9 indicates that for fiscal 1953 the RFC Synthetic Rubber Division expects to make a profit of $43,235,500, and for fiscal 1954, a profit of $58,799,000, without any appreciable increase in the 23¢ a pound price for GR-S.

Because of a contest between RFC and the Petroleum Administration for Defense for butylenes, the planned expansion of GR-S production for the first quarter of 1953 may be reduced somewhat. A first-quarter production of 172,250 long tons of GR-S, however, has been scheduled.

Price controls on original equipment tires have been suspended by the Office of Price Stabilization, and suspension of those for replacement tires and camelback and repair materials is being considered.

In both the United States and Canada, leading industry executives continue to look for a high level of production and sales in 1953.

Under private industry operation the selling price of GR-S was estimated at between 18 and 28¢ a pound for the immediate future and between 25 and 30¢ a pound for the long-term future, by Howard H. Heilman, consulting chemical engineer, writing in the January, 1953, issue of "Natural Rubber News".

Under sponsorship of the Mutual Security Agency, a group of Norwegian management, labor, and government representatives is visiting American rubber goods plants and laboratories during the months of January and February.

Washington Report by Arthur K. Kraft

Synthetic Rubber Plant Disposal Developments

Although January was a quiet month for developments relative to the disposal of the government's synthetic rubber plants, activity will increase from now on. The Parsons engineering survey of the facilities, designed to set a cash value on each plant, is to be submitted to RFC about February 1. RFC is then expected to call in rubber officials and perhaps those of the interested chemical and petroleum firms to exchange ideas on the Parsons report's findings.

The engineering firm has been asked by RFC to establish the current replacement cost of each of the plants. According to one outside expert, to replace these plants built in 1942-44 would cost nearly twice as much today. It seems highly doubtful, however, that RFC will try to set selling prices for its plants at anywhere near double their original cost, but it may be expected to seek higher prices for the plants than most companies would like to pay.

After the digesting of the Parson report, the next task is the drafting of a report on disposal which RFC must submit to the President and Congress by March 1. This will include RFC's recommendations on the feasibility of disposal and may also make a number of specific recommendations in terms of a concrete plan—or at least the outline of one—to guide disposal policy. It will then be up to President Eisenhower, who is required by law to submit his recommendations on disposal to Congress by April 15.

A question of considerable interest, and perhaps of major bearing on the eventual outcome of the disposal issue in Congress, is which committees of Congress will consider these reports. In the House, the Armed Services committees has had sole jurisdiction in each Congress since the Eightieth (1947-48) and has no present rivals. In the Senate, the banking and currency and Armed Services committees have vied for jurisdiction, with the former holding it during the Republican Eightieth Congress and the latter in the last two Democratic Congresses. In the upper house the jurisdictional dispute has been carried primarily by two men, Senator Bricker and Senator Johnson. Each may be expected to have a deep interest in the future of the synthetic rubber industry in the new Congress. Senator Bricker, reelected this past November for another six-year term, has been notably responsive to the tire industry's wishes in the past and has already pledged to take an interest in the current Congress' consideration of the disposal issue. He may be expected to want jurisdiction of the administration reports on disposal referred to the banking committee, where he could again sit as chairman of a subcommittee on rubber. In view of the fact that the nation has achieved a strong security position in rubber in the past few years, and the need of government action to secure this strength is no longer urgent, jurisdiction by the Armed Services committee is of less importance. At the same time, disposal of synthetic rubber facilities has taken on more of the aspect of a purely financial matter—how much money industry will pay for the plants. The banking committee traditionally has had jurisdiction of RFC.

Actually, no one is disposed to look upon the synthetic rubber plant disposal question purely from its military-security aspect or as a strictly financial question. It is a matter of emphasis, and the emphasis apparently is changing from a military-security to a financial question. National policy, as repeatedly stated by Congress, is to create a privately owned, competitively operated synthetic rubber industry as soon as national security considerations permit. The Armed Services committees have taken the view that the transfer from government to private ownership should be made only when it has convincing evidence that a privately run synthetic rubber industry will stand ever ready to assure the nation's security needs in rubber without government props. It is only because such evidence can now be supplied that Congress has been willing to consider disposal at this time.

Senator Johnson, now minority leader of the Senate, has an additional interest in the future of the synthetic rubber industry. Most of the synthetic rubber plants, or the big ones, are in Texas, where they make contribution to the economy of that state. Senator Johnson's term of office expires in two years, and he wants to be reelected. In Texas, Senator Johnson has often identified synthetic rubber with the welfare of Texans and may be expected to demand to be a part of any consideration of the disposal of that industry by Congress. He has had the dominant voice in the post-Korean reactivation of the industry as a member of the Armed Services committee and speaks with some authority on rubber policy in Congress.

Several oil companies, very influential in Texas, are becoming interested in the government's synthetic rubber plants and their future disposition. Even should Senator Johnson wish to remain aloof from an issue which might develop into a tug-of-war between various industrial interests, he is bound to be dragged into the issue by his constituents, where he could be expected to press for quick decisions and a major role for himself in any resolution of the legislative questions involved. As a leader of the Senate's 47 Democrats, he is in a position to exert some leverage both on other Democratic Senators and on the Republican leadership.

Should jurisdiction over the disposal issue remain with the Armed Services committee, of which Senator Johnson is a member the rubber industry will not be without friends. The new chairman of that committee is Leverett Saltonstall (Rep., Mass.). Although he has not taken a preeminent interest in rubber matters, he intervened with Senator Johnson last year to reduce the period by which the Rubber Act was extended. A new member of the Armed Services committee with some experience in rubber matters is Stuart Symington, (Dem., Mo.), who headed the RFC a year or more ago.

It is expected that the RFC report to the President and the Congress on March 1 will take the position that it is up to the industry to sell Congress on the need of transfer of the synthetic rubber plants to private industry, since security considerations are no longer paramount. RFC may recommend a price floor for the various plants, below which no sales should be made.

RFC Budget Indicates Higher Rubber Sales and Profit

RFC is looking toward increased sales and higher profits from its synthetic rubber operations in the 1954 fiscal year, despite a $30 million program of capital expenditures, chiefly for converting petroleum butadiene plants to use of the new Dow catalyst.

These facts were revealed in the fiscal 1954 Budget of the U. S. Government presented by the President to Congress on January 9. Based on expected industry requirements, RFC expects to produce 735,000 long tons of synthetic rubber in fiscal 1954 (the 12-month period ending June 30, 1954). The 735,000 tons would be produced at a cost of $249.2 million. RFC expects production in the current fiscal year which ends June 30, 1953, to total 660,000 long tons, costing $223.6 million, a somewhat higher unit cost than projected for fiscal 1954.

In the 1953 fiscal year, RFC is spending $36.2 million to complete the conversion to cold rubber (aiming at a 75/25 ratio of cold to hot GR-S capacity) and for capacity expansion, as well as for various process improvements and plant equipment replacements.

Perhaps the most significant figure is the amount of net profit RFC expects to take in from its synthetic rubber operations in the 1954 fiscal year—a whopping $58,799,000 on sales totaling $392,388,000 (the latter figure includes $18 million in freight charged to customers). This figure works out to a net income of 15¢ on each dollar of sales. It seems almost obvious that these RFC projections of income will be talked of a good deal in connection with discussions looking toward disposal of the synthetic rubber plants to private industry.

The profit expected for the 1953 fiscal year is also considerably higher than heretofore—$43,235,500, according to the President's budget, on total sales of $351,417,000 (the latter includes $16,170,000 in freight charged to customers). These figures may be compared with the actual profit of $16,113,542 in fiscal 1952, made on sales of $435,080,888 (including $19,148,351 in freight charges).

The reason for the big difference between the profit and cost figures for the years covered is in RFC's calculations of the cost of purchasing and processing materials into rubber—a $351,815,687 item last year and one projected at only $223,626,000 in fiscal 1953 and $249,193,000 in fiscal 1954, when RFC expects to reach its objective of attaining sufficient low-cost petroleum butadiene capacity to produce 860,000 tons a year of GR-S. RFC is apparently not only counting on operating its entire program on petroleum butadiene, but also anticipates maintaining its current selling price of 23¢ a pound for GR-S, or pretty close to it.

An item of about $1.8 million in each of the fiscal years 1953 and 1954 for expenses of maintaining standby plants evidently assumes that the alcohol butadiene plants will be in standby in both years. This will not be so through most of fiscal 1953, since most of the units shut down on September 1, 1952, were ordered reopened in December and January and seem likely to stay in operation at least through April, 1953.

The following tabulation, taken from the President's budget, is a statement of income, expenses, and retained earnings for the fiscal years ending June 30, 1952, 1953, and 1954.

Synthetic Rubber Program

	1952 Actual	1953 Estimate	1954 Estimate
Income:			
Sales:			
Synthetic rubber	$415,932,537	$335,247,000	$374,388,000
Freight charged to customers	19,148,351	16,170,000	18,000,000
Total income	$435,080,888	$351,417,000	$392,388,000
Expenses:			
Cost of goods sold:			
Purchase and processing costs	$351,815,687	$223,626,000	$249,193,000
Increase (—) or decrease in inventory	—20,690,982	297,400	.....
Cost of goods sold	331,124,705	223,923,400	249,193,000
Freight	19,044,102	16,170,000	18,000,000
Administrative expense	2,391,765	2,215,000	2,205,000
Research and development	6,939,476	6,458,500	6,375,000
Expenses for maintenance of stand-by plants	136,581	1,710,100	1,816,000
Other	9,539,556	4,739,000	.....
Total expenses	369,176,185	255,216,000	277,589,000
Net income from operations before reserves and deduction of interest on investment	65,904,703	96,201,000	114,799,000
Reserves:			
Depreciation	41,485,515	44,965,500	48,000,000
Shutdown expense	3,000,000	.....	.....
Self-insurance	.....	2,000,000	2,000,000
Subtotal	44,485,515	46,965,500	50,000,000
Interest on funds invested in net operating assets	5,305,646	6,000,000	6,000,000
Total	$49,791,161	$52,965,500	$56,000,000
Net income from synthetic rubber program	$16,113,542	$43,235,500	$58,799,000

The budget also contains the following statement of assets of the RFC synthetic rubber program. For convenience, all figures are given as millions of dollars:

	Actual		Estimate	
As of June 30	1951	1952	1953	1954
Cash advanced to operators	$ 1.8	$ 8.2	$ 7.5	$ 8.0
Accounts receivable	7.8	25.7	25.0	25.0
Inventories:				
Synthetic rubber, raw materials, chemicals and processed stock	60.0	68.8	72.1	67.4
Supplies, spare parts, tools	13.7	14.9	14.9	14.9
Total inventories	73.6	83.7	81.7	82.3
Property, plant, equipment	496.4	511.9	542.0	566.0
Less portion charged off as depreciation	.....	338.6	377.4	419.4
Net property, plant and equipment	496.4	173.3	164.6	146.6
Prepaid taxes, insurance, and other deferred charges	1.4	2.5	2.5	2.5
Total assets, synthetic rubber program	581.1	293.4	286.6	264.3

The significant figures in this listing of assets are those for property, plant, and equipment. In any discussion between RFC and private industry over the prices at which the plants should be sold, industry is likely to balance RFC's rosy profit figures by pointing to the agency's own figures showing that by June 30, 1954, all but $140,573,000 of an investment valued at $566,000,000 will have been written off the books.

Butylene Supply Slows GR-S Expansion Somewhat

RFC went ahead in January with plans to reactivate four units of its alcohol butadiene facilities, calling upon the trade for 15 million gallons of alcohol to feed the two units reopening at Louisville, Ky., and the two at Kobuta, Pa. Deliveries of five million gallons monthly in February, March, and April were requested.

The agency received a setback to its plan to bring GR-S output up to a quarterly rate of some 180,000 long tons by late February, however, when it was denied full use of its contracts with butylene suppliers from January 1 onward. The Office of Defense Mobilization ordered RFC to continue permitting aviation gasoline refiners to take some 2,800 barrels a day of these butylenes until January 20 and on January 15 ordered a further 30-day extension for 1,700 barrels a day.

RFC originally had released these butylenes, coming to it under long-term contracts with refinery suppliers, last summer, when it appeared that rubber requirements would remain low enough for some months ahead to permit the rubber program to get along on reduced output of petroleum butadiene from butylene. The 2,800 barrels a day of butylenes were put at the disposition of the Petroleum Administration for Defense, giving PAD permission to divert this quantity from synthetic rubber to aviation gasoline refineries until December 31, 1952. PAD and the Armed Services Munitions Board in December sought an extension of this loan, contending that its termination—given the scarcity of butylenes and its equivalents, such as codimer—would result in lost production of high-octane aviation gasoline, needed for military operations.

RFC insisted on the December 31 termination of the arrangement, pointing out that the butylenes would be needed immediately for expansion of synthetic rubber production. The Munitions Board and PAD appealed to ODM, and a meeting was held in the office of ODM Chief Henry Fowler on December 19, and Fowler's decision in favor of PAD and the Munitions Board resulted. PAD acted immediately, serving several directives on butylene suppliers to ship to specified aviation gasoline refineries.

Under Fowler's order, PAD was to take steps to find alternate sources of butylenes for the aviation gasoline program. Meanwhile RFC went out on its own to seek free supplies of butylenes to make up the quantities of which it had been deprived by ODM. Some success was reported by RFC officials although they had to pay higher prices than those specified under its contracts. Both government and industry rubber men regard their dispute with the Munitions Board and PAD as coming down to a question of price. They contend that there

is no shortage of butylenes, but it is a matter of who has to pay for the premium priced material—rubber or aviation gasoline producers.

PAD did not dispute that price is a factor, but took the position that it needed more time to find the substitute sources of butylene or codimer. Apparently, this agency was confident that it could hold on to the RFC butylene contracts by putting up a case that aviation gasoline was more essential to the defense program than rubber. PAD obtained at least a temporary reprieve in connection with the RFC contracts on just such an argument.

The rubber program, insofar as the expansion of GR-S production is concerned, will be slowed down somewhat, although probably no more than a couple of thousand tons a month and perhaps a good deal less. Fowler's decision of December 31 in favor of PAD will require RFC to continue through February the 94% limitation on deliveries of GR-S instituted on January. The limitation is expected to be removed in March. Production of GR-S for January is estimated at 54,000 long tons, for February at 55,250 tons, and for March at 63,000 tons, for a total first-quarter production of 172,250 long tons. The considerable increase in March production results from a significant increase in availability of alcohol butadiene.

The dispute over butylenes gives emphasis to one aspect of the raw materials problem that private producers of synthetic rubber may have to face, that is, stiff competition for butylenes from the aviation gasoline industry—an industry which apparently can gather strong government allies to help it out of its problems. Some time ago, with help from PAD, it managed to get an exemption from price controls for aviation alkylate (which is what the butylenes are used for) used in the aviation fuel sold to the military.

Control on Tires Dropped; Other OPS News

OPS in late December suspended controls on original equipment tires with the proviso that controls would be reimposed should prices hit the "trigger point"—rise to the previous ceiling.

The OPS clearance committee early in January approved a lower echelon proposal to suspend price ceilings on camelback and repair materials, and an official said a new regulation to suspend these ceilings is being drafted by OPS lawyers and should be ready for issuance at the end of January. Proposals to include replacement tires in the suspension regulation are before this committee.

OPS enforcement officials had taken no definitive action in late January on a possible claim against tire manufacturers for violating ceiling price regulations in the sale of second-line low-pressure passenger-car tires. In mid-December the agency's enforcement division sent a questionnaire to the five manufacturers involved in the case to get data on the total number of tires sold at above-ceiling prices. The questionnaire also went to private-brand tire makers, bringing them into the case for the first time.

While this case might yet be referred for enforcement action to the Justice Department, the general impression is that it will be dropped, in view of the divided opinion within OPS as to whether violations actually took place. The unanimous position taken by all tire makers was that the OPS interpretation which may have been violated came after the alleged violations took place and runs counter to industry's customary pricing practices.

Joseph H. Freehill, director of OPS, predicted in January that in the event all price controls are dropped, price increases are likely to come in rubber-working machinery and rubber tire and tube machinery (including recapping and retreading machinery). These were two of the some 150 industrial materials and commodities and related manufactured goods whose prices are likely to rise in the event of decontrol and were listed in a memorandum to Economic Stabilizer Michael V. DiSalle on January 16. Current legislation authorizing price controls expires April 30. They could be ended earlier by Presidential order, or continued by new legislation.

No rubber products were included in Freehill's long list. According to his memorandum, annual sales of rubber working machinery are an estimated $76 million; while he put annual sales of rubber tire and tube machinery at $55 million.

H. H. Peterson resigned as chief of the tire section of the OPS Rubber Branch on January 1 to return to his executive post with Armstrong Motors in Washington, D. C. Larry Williams, an assistant, was named acting chief on January 5.

Murray Tire Bill Introduced Again

Sen. James E. Murray (Dem., Mont.) has introduced a bill (S. 175) which would require "that all new, rebuilt, retreaded, and recapped tires, all casings and tubes, and all camelback and other material for rebuilding, retreading, or recapping tires, sold or delivered in the course of trade or business to consumers (except governmental agencies) shall be sold or delivered only by or through independent tire dealers."

The bill, referred to the Senate Judiciary committee, exempts tires and tubes sold as original equipment with motor vehicles. The same bill has been introduced in the past few Congresses by Senator Murray in the Senate and Wright Patman (Dem., Tex.) in the House, has reached the stage of committee hearings, but has never reached the stage of a floor vote in either chamber.

The bill has been initiated at the request of the National Federation of Independent Business, Inc. If adopted, it would flatly prohibit the sale of tires, tubes, and repair materials to the public by tire-manufacture retail outlets, chain stores, and retail gasoline stations, which, among them, account for nearly half the tires now sold to the public. The bill provides a $5,000 fine and a year in jail for anyone convicted of violating it.

Meanwhile the National Association of Independent Tire Dealers forecast in Washington in January that the dealers will sell 52 million replacement passenger-car tires in 1953, "if industry can provide them." This figure is two million units higher than the largest estimate of 1953 sales made by any manufacturer, NAITD said. This trade group also forecast that truck tire replacement sales will reach 10 million units and that 21 million tires—13 million passenger and eight million truck— will be recapped this year.

More Federal Aid for Roads Asked

Senators Warren Magnuson (Dem., Wash.) and Henry Kilgore (Dem., W. Va.) have introduced a bill (S. 216) which would set aside the proceeds of the manufacturers' excise taxes on automobiles, tires and tubes, gasoline and lubricating oil for the purposes of the Federal-Aid Road Act.

Under the bill the Federal Government, beginning July 1, 1954, would appropriate out of a Federal Aid Highway Trust Fund an amount equal to the collection of taxes from the above sources in the preceding year. It would be spent for primary, secondary, and urban highways. To the above revenues going into the Federal Aid Highway Trust Fund, Congress would add $20 million to be used for state-sponsored road safety research in the following year.

The Magnuson-Kilgore bill also provides a $550-million appropriation for the fiscal year beginning July 1, 1953. This would be apportioned among the states for road building projects and would be available for expenditures until June 30, 1956.

The bill was referred to the Senate Committee on Public Works and is expected to get a good deal of attention and support from many groups, including the tire industry, which have banded together in the past year to impress upon the public the great need of improving the nation's highway system.

The American Association of State Highway Officials, meeting in Kansas City late last year, noting a lack of sufficient state funds to undertake a full-scale highway modernization program, urged the Federal Government to increase federal aid appropriations for highways so that it at least equals the revenue from Federal Government gasoline tax collections. Other groups have suggested that the Federal Government allow the states to collect for their own highway use the amount the Federal Government takes in on gasoline taxes. The Magnuson-Kilgore bill goes well beyond this point, setting aside other tax revenues, besides gasoline tax revenues for state highway use.

RFC Buys 15 Million Gallons of Alcohol

Reconstruction Finance Corp., Washington, D. C., has purchased approximately 15 million gallons of alcohol from Eastman Chemical Products Inc., Enjay Co., and Publicker Industries, Inc., for use in the production of butadiene at two government synthetic rubber plants, Administrator Harry A. McDonald announced on January 21.

Terms of the purchase call for delivery of the alcohol f.o.b. barge or tank cars at the RFC's Louisville, Ky., or Kobuta, Pa., plants on the basis of measurements by the Alcohol Tax Unit of the Bureau of Internal Revenue. Deliveries will be made at the rate of approximately five million gallons a month during February, March, and April.

Quotations for the alcohol were requested in anticipation of requirements that will develop in the next several

months as the result of the reactivation of four alcohol butadiene units at Louisville and Kobuta.

Administrator McDonald on January 23 ordered the reactivation of an additional copolymer line at the RFC's synthetic rubber plant at Institute, W. Va., in order to meet increased requirements of the nation's rubber industry.

Reopening of the Institute unit will make possible production of an additional 3,500 long tons of GR-S hot rubber each month. Engineers estimated that the unit could be in operation within a period of 30 days.

Other National News

Industry Executives Statements Continue Optimistic

A few more year-end statements by leading executives in the rubber and associated industries have been received and they all continue the optimistic tone expressed in those reported last month.

P. W. Litchfield, chairman of the board, Goodyear Tire & Rubber Co., pointed out that 1952 marked the fourteenth consecutive year, since 1938, in which the rubber industry has enjoyed growth and gains. Looking ahead to 1953, he saw every reason to anticipate an even greater volume for the industry, in terms of employment, payroll, sales, and service to the consuming public.

It was again emphasized that we should have a new national rubber program which would: (1) bring new rubber plantings to the Western Hemisphere; (2) increase synthetic rubber production capacity now; (3) create a security and buffer stockpile of 200,000 tons of synthetic rubber.

W. O'Neil, president and chairman of the board, General Tire & Rubber Co., hailed 1953 as a banner replacement tire sales year and saw a 5% increase in passenger-car tire sales, a 14% increase in truck tire sales, 12% more farm tires sold, and a continuation of the present high volume of industrial pneumatic tires sold. He added that the percentage increase in tire poundage will far exceed the percentage increase in number of units produced because of the increasing rate of production of giant tires.

J. P. Seiberling, president, Seiberling Rubber Co., reported mostly on the prospects for that company. He expected Seiberling unit sales of tires to increase at a somewhat higher rate than for the industry because of unfilled orders from 1952 and new tire products, including a 100-mile an hour tire. Greater diversification of Seiberling business and some modernization of selling policies, with a view to further leveling of the company's year-around production schedules and increased stabilization of employment, are planned.

Production from new and expanded installations and the introduction of new and improved products will considerably enlarge the services of Koppers Co., Inc., to industry and, thus indirectly, to the nation. Gen. Brehon Somervell, Koppers chairman and president, said. Full production of ethylbenzene at the new Williams plant near Port Arthur, Tex., and manufacture into polystyrene plastic molding compounds at the Kobuta, Pa., plant were mentioned. New polystyrenes with high shatter resistance, and a new emulsion involving the use of styrene for the manufacture of water-base paints have been developed and readied for commercial distribution, it was added.

In Canada, C. C. Thackray, president of Rubber Association of Canada and of Dominion Rubber Co., Ltd., said that after mid-1952, aided by tax reductions and the easing of credit restrictions in the federal budget, the tire division of the rubber industry made a good recovery from a sales slump of about a year's duration and ended 1952 with a more or less normal postwar sales volume. For 1953, the automobile industry's production plans combined with steadily mounting motor vehicle registrations and gasoline consumption hold out the promise of a moderate increase in sales.

Canada should enjoy a continuing high level of industrial activity and general prosperity during 1953. The industrial products division of the rubber industry, therefore, may look forward to the coming year with confidence. The Canadian footwear division, however, is concerned about the effect of a heavy influx of low-priced rubber footwear from Hong Kong, where wages in the industry range from 45 to 75¢ a day. Normal tariffs do not provide adequate protection, and unless more effective protection is provided by the Canadian Government, the rubber footwear industry will probably lose a substantial volume of sales, it was said.

Synthetic Rubber Cost Analysis

An article, "Synthetic Rubber Cost Analysis," by Howard H. Heilman, consulting chemical engineer, Los Angeles, Calif., appeared in the January, 1953, issue of "Natural Rubber News," publication of the Natural Rubber Bureau, Washington, D. C.

The author stated that the studies of the cost and selling prices of synthetic rubber, assuming it is manufactured by private enterprise, were the basis for his conclusions listed below. Observations are presented for both the immediate and long-term future, the latter represented by a target date of 1960. The conclusions follow:

1. For any period and under any operating system, the level of synthetic rubber consumption is a primary determinant of selling price.

2. Considering the *immediate future*, a wide range of selling price is possible, depending on the manner of disposal (whether by lease or for replacement value), level of market demand, and the degree of plant integration achieved. If replacement values are obtained for the synthetic rubber plants, the selling price would range from 25 to 26¢ a pound, with demand up to 450,000 long tons a year. Consumption up to 600,000 tons a year would necessitate prices of 26 and 28¢ a pound. If the plants are leased or are sold at severely depreciated values, plus a low profit return to private industry, the selling price could average 22¢ a pound, up to 600,000 tons yearly production, with a range extending from 18 to 24¢, depending on specific plant and location.

3. The *long-term future* selling price for synthetic rubber will be within the broad range of 25 to 30¢ a pound. Low consumption, 400,000 to 500,000 long tons a year, could be served by 25 to 26¢ prices. Greater demand, even above the capacity of existing facilities, could be met by selling for 28 to 30¢ a pound. The depressing effect upon selling prices through leasing of the plants, or sale for depreciated values, is of less magnitude for the long-term future than for the immediate future. Regardless of the value obtained for the plants, the gradual obsolescence, rehabilitation cost and replacement investments which will be required would result in the price range of 25 to 30¢ a pound.

4. For any given selling price for cold rubber, the oil-extended or masterbatched synthetic rubber will sell for 3 to 5¢ less a pound, depending upon the proportion of oil used, or selling price ranges for oil-extended rubber of 20 to 26¢ a pound. The development of oil-extended synthetic rubber is of prime importance to the economics and technology of the industry, and major use of this type is indicated.

If the synthetic rubber plants are disposed of to private industry, the price of synthetic rubber could vary over wide ranges, depending upon the method of disposition and the demand for rubber. Purchase of plants at replacement values, if butadiene and copolymer plants are operated as separate units by different companies, would result in major price increases. Low market demands could be served by low-cost plants. Higher market demands, if served by existing facilities, mean higher synthetic rubber prices. Disposal on a lease basis or for greatly depreciated plant values, joint operation of facilities or similar conditions mean lower prices, it was said.

Norwegian MSA Productivity Team in U. S.

Mutual Security Agency in Washington announced last month that nine representatives of Norwegian management, labor, and government were spending the period from January 16 to February 24 studying productivity techniques in the American rubber industry. The survey, sponsored by MSA, will include visits to plants in New Jersey, Massachusetts, and Ohio.

The team's specific interests will include automobile tires and tubes, hose, conveyor and transmission belts, footwear, and foam rubber goods. The team will give special attention to materials handling, standardization, quality control, time studies, and labor-management relations.

Sverre Hassel, technical manager, A/S Askim Gummivarefabrik, is the team leader. Other members are: Lief Andresen, secretary, Norwegian National Union of Chemical Industry Workers; Oskar Brattlie, worker, and Arnfinn Haheim, chief engineer, both of A/S Viking Remfabrik; Olaf Karlsen, rubber mixer, A/S Askim; Knut Nergaard, secretary, Royal

Norwegian Ministry of Industry; Knud Nicolaysen, secretary, Norwegian Employers Association; Bjorn Refsum, owner and manager, Refsums Gummivarefabrik; and Jacobus van Zyl, technical manager, A/S Gummifabriken National.

The MSA project manager is M. H. Prang.

The team members participated in an industry orientation meeting, arranged by officials of The Rubber Manufacturers Association, Inc, in New York on January 19. The itinerary for the plant visits follow: January 20, United States Rubber Co., Passaic, N. J.; January 22, Acme Rubber Mfg Co., Trenton, N. J.; January 23, Boston Woven Hose & Rubber Co., Cambridge, Mass.; January 26, special conference with Arvid Corneliussen, Snap Fastener Division, United-Carr Fastener Corp.; January 27, Converse Rubber Co., Malden, Mass.

The team will visit Akron, O., and neighboring areas from January 29, to February 10, with the following trips scheduled: January 29, E. I. du Pont de Nemours & Co., Inc., rubber laboratory; January 30, United Rubber Workers, C.I.O.; February 2 and 3, Firestone Tire & Rubber Co.; February 4, Ohio Rubber Co., Willoughby; February 5, Faultless Rubber Co., Ashland, O.; February 6, International Chemical Workers Union, AFL; February 10, B. F. Goodrich Research Center, Brecksville, O.; and, B. F. Goodrich Chemical Co., Avon Lake, O.

On February 11 the team will visit Textileather Corp., Toledo, O.; and, on February 12, Dayton Rubber Co., Dayton, O. On February 13, the Cincinnati Rubber Mfg. Co., Cincinnati, O., will be visited.

The team will spend from February 14 to 20 in Washington, D. C. On February 16 it will visit the U. S. Department of Labor, Office of International Labor Affairs; on February 17, the American Council on Education; on February 18, the National Planning Association; and on February 19, will meet with MSA officials.

The team will return to New York on February 21 and leave for Norway on February 24.

Goodrich Gets SEP Award

The B. F. Goodrich Co., Akron, O., recently received a plaque from the *Saturday Evening Post* in recognition of 50 years of continous advertising in that magazine. The presentation made by *Post* President Robert E. MacNeal, was accepted by John L. Collyer, Goodrich president. The first Goodrich ad to run in the *Post* featured rubber brownies, and the company's first tire ad appeared in 1907.

Frank A. Duffy, president of Duffy Tire Co., Trenton, N. J., has been made manager of retail stores operations of The General Tire & Rubber Co., Akron, O. Named also in this major sales program change for General Tire is **Bernard J. Duffy,** who will serve as assistant to his brother in General's coast-to-coast retail operations. In their new assignments, Frank Duffy and his brother will assist in the retail operations of distributors receiving financial assistance from the parent company, and they will also fashion a retail program which other General Tire distributors can utilize.

Miller New Plant Manager

Donald J. Miller of Long Beach, Calif., has been appointed manager of Monsanto Chemical Co.'s new plant at Avon, Calif., effective January 1.

Frank S. Bonham, of Springfield, Mass., succeeds Miller as manager of the Long Beach plant, effective March 1.

The new plant at Avon will manufacture phenol and other heavy chemicals. The Long Beach unit produces styrene and Krilium soil conditioner.

Miller joined Monsanto in 1941 at its Springfield, plastics division plant. During World War II he served with the United States Navy. After the war he returned to Springfield as a laboratory supervisor.

Bonham started with Monsanto in 1941 in the control laboratory at the plastics division. Later he served at the Longhorn Ordnance Works in Texas, maintained by Monsanto during the war for the United States Ordnance Department. Following his return to Springfield, Bonham was employed as a supervisor in the Resinox plant of the plastics division and most recently was on special engineering assignment for the division.

Begin Shipments of Acrylonitrile

Monsanto also announced that the initial shipment of acrylonitrile from its new facilities at Texas City, Tex., was made on December 30. Charles A. Thomas, Monsanto president, and J. R. Mares, vice president and general manager of the Texas Division, participated in ceremonies christening the first tank car of acrylonitrile to leave the plant. The first car was shipped to Chemstrand Corp., Decatur, Ala., for use in the production at Acrilan acrylic fiber. Future production at Texas City will be divided between Acrilan and other chemical products, including nitrile rubber, copolymer resins and emulsions, plasticizers, and dyes.

Predict Expanded Use of Phenolics in Foundry Field

A marked increase in production of phenolic resin for the foundry industry that will continue through 1957 was forecast by Robert K. Mueller, general manager of Monsanto's plastics division. He estimated that recent developments in casting procedures virtually assured an industry-wide production volume in phenolic resins to nearly 17 times the 1952 figures. Resins used in the shell mold process have more than doubled each year since 1950 and are now produced at a rate of several million pounds annually. The plastic is used to bond a thin, strong sand shell for castings, and the process gives more precise castings as well as substantial savings in capital investment, floor space, finishing operations, and handling. Mueller stated that Monsanto's production of phenolic resins for this use alone represented about 80% of the industry's total in 1952.

"In order to meet industry demands, we are scheduled to produce about twice as much this year," he said. "At the same time, we anticipate that the industry will nearly quadruple its manufacture of resin for shell molding."

Monsanto Plastics at Housewares Show

Products featuring Monsanto plastics, as well as improvements in styling and coloring, were very much in evidence at the National Housewares Exhibit in Chicago, Ill., during January. Among the exhibitors was Blisscraft of Hollywood with a new set of table accessories molded of Lustrex polystyrene. A Lustrex wall tile kit, complete with all needed materials, tools, and instructions, and molded styrene home planting units operating on the hydroponic principle were shown by Earl Fisher Plastics Co.

A new note in the shower curtain field was shown by Plastron, Inc., with its scented Ultron vinyl curtains having designs made with fiber flocking. A decided shift toward stronger plastics, such as Lustrex LH, an improved impact resistant styrene, was noted in the displays by Victor Mfg. Co., Transparent Specialities Corp., and Gits Molding Corp. Victory featured hand painted canisters, a dripproof pitcher with a beaker spout and a two-toned breadbox. Bottom tapered canisters for easy holding were shown by Transparent Specialties, in three-piece sets, each with a one-pound capacity. New graduated styrene bowls with polyethylene covers were exhibited by Gits Molding.

Plastics Division Reorganized

Monsanto's plastics division has reorganized its sales department to keep pace with the rapidly expanding markets for industrial resins, according to R. C. Evans, general manager of sales.

Industrial resins will be assigned to a newly created section of the sales department to be headed by Edmond S. Bauer, Jr., who has been promoted to sales manager of industrial resins, bringing to seven the total number of product sales managers in the division.

David L. Dondy has been advanced to assistant sales manager of industrial resins under Bauer.

The latter joined the plastics division in 1942, as a research chemist. Later that year he became a technical service engineer in the sales department and since 1947 has been an assistant product sales manager handling the sale of industrial resins.

He is the author of several articles on resin developments and applications.

Dondy started with the division at Springfield in 1946, having been previously associated with Mitchell Plastics Co., as plant manager. After serving with the plastics division as sales correspondent for one year, Dondy was assigned to the division's St. Louis branch office as a salesman in 1947. He was transferred to the Chicago branch office in 1950 in the same capacity.

Ralph E. Hammer and Robert R. Moyer are recent additions to the sales department of the plastics division. Both have been assigned to technical service for thermoplastic molding materials.

Hammer, a former materials engineer in the plastics department of General Electric Co., has broad experience with printing inks, lacquers, paints, and coated fabrics.

Moyer is a former employe of the plastics division of Continental Can Co.

Both men have completed their training program and have been assigned to field work.

D. M. Raleigh has been named product manager of the light mechanicals department of Boston Woven Hose & Rubber Co., Cambridge, Mass. Until recently Mr. Raleigh had been associated for 16 years with The B. F. Goodrich Co., as manager of the special industrial merchandise division.

Fred Wachter

Paul H. Rossiter

David L. Gamble

Wachter, Rossiter Upped

Andrew Hale, president of Hale & Kullgren, Inc., Akron, O., designer of machinery and processes for rubber and plastics, recently associated with The Aetna-Standard Engineering Co., Ellwood City, Pa., has announced the appointment of Fred Wachter as sales manager for the National Erie Division of Hale & Kullgren, and Paul H. Rositer, engineer for the same division.

Prior to joining Hale & Kullgren, Wachter was sales engineer for National Erie Corp., for 12 years. Wachter also had been associated with Chicago Bridge & Iron Co., Reeves Brothers Division, where he had been engaged in estimating, engineering, and sales. Prior to that position he had worked for Blaw-Knox in its processing equipment division and for Treadwell Engineering Co.

Rossiter came to Hale & Kullgren in March, 1952. He was in charge of design engineering at National Erie for eight years. Before joining National Erie, Rossiter headed all mechanical installations and machine designs for special equipment for Pan American Airways in Central America, South America, and the West Indies.

New Firm to Mold Kel-F

Flek Corp., 2252 E. 37th St., Vernon, Calif., has been formed to specialize in the molding of Kel-F trifluorochloroethylene plastic. This new company has completed the installation of modern equipment for injection, transfer, compression, and extrusion molding. Although equipped to mold all industrial plastics, Flek will specialize in Kel-F, which is used extensively in the electrical, electronic, chemical, petroleum, and aircraft industries. The firm has also installed equipment for the application of Kel-F dispersions and the electronic welding of plastic sheet and film into vessel liners and flexible containers.

Robert L. Cummer is president of the new firm, and Jay W. DeDapper is general manager. Mr. DeDapper was formerly responsible for chemical operations at the Electrofilm Corp. and has been closely associated with application research on Kel-F both at Electrofilm and North American Aviation Corp.

Snyder Firm Incorporated

M. L. Snyder & Co., Philadelphia 25, Pa., manufacturer of rubber proofed goods, through President Herbert A. Greene, announced its incorporation as of January 1. This year also marks the company's seventy-fifth anniversary, and the firm, after running as an individual enterprise, has grown so large as to make incorporation desirable for future expansion being planned. The firm has made a separate corporation for its George A. Johnson Co. plant and business on the West Coast, and a separate corporation for its D. O. Frost Co. plant and business on the East Coast. The Canadian plant and business remains unincorporated and under the proprietorship of Mr. Greene.

Other officers of Snyder are Herbert M. Simpson, executive vice president; Samuel Wolf, vice president in charge of operations; Cassin Snyder, treasurer; and Harry O. Lodes, secretary.

New Plant to Repair Tank Tracks and Wheels

Detroit Arsenal, Center Line, Mich. has announced the completion of a pilot-plant for reconditioning and retreading tank tracks and roadwheels.The life expectancy of new tracks and roadwheels is approximately 2,500 miles, and the equipment was discarded after this distance because the wheels were so worn and warped that they could not be resurfaced with rubber. At the same time, the guide flanges on the used wheels were so worn as to be unsatisfactory for continued service.

According to W. D. England, chief of the Arsenal's rubber branch, two stages are involved in processing the wheels for reuse. The first step utilizes a special rapid welding process to build up the worn flanges, which are then machined to proper size. The second step is the application of a new tire on the wheel, using molds and presses made of rolled steel rather than castings, and designed to be sufficiently flexible to absorb the irregularities of the warped wheels. Each wheel salvaged in the new plant is said to provide an immediate saving to the government of $40, and the process also entails savings in steel and a reduction in required inventory levels of new wheels.

Gamble Research Manager

The New Jersey Zinc Co. (of Pa.), Palmerton, Pa., has appointed David L. Gamble manager of research to succeed George F. A. Stutz, who has been transferred to the New York office as development engineer. Mr. Gamble entered the employ of New Jersey Zinc in 1925 and has held various positions in the research, department.

Robert K. Waring has been advanced to assistant manager of research, the position formerly held by Mr. Gamble. Dr. Waring has been in the research department of the company since 1928.

Witco Moves Office

Better to handle the expanded operations of its main office in New York, Witco Chemical Co. has moved to larger and more modern headquarters in the new building at 260 Madison Ave., New York 16, N. Y. The telephone number, MUrray Hill 5-6020, will remain the same.

This is Witco's first move since 1935 and the second in the company's 33-year history.

Building Aircraft Presses

United Engineering & Foundry Co., Pittsburgh, Pa., is building five new hydraulic die forging and extrusion presses under the Air Force's heavy-press expansion program to facilitate production of better aircraft. The company is building 110,000 tons or slightly more than 25% of the (400,000) tons of heavy-press capacity called for under the program. United's part consists of two 35,000-ton forging presses, one 8,000-ton forging press, one 12,000-ton extrusion press, and one 20,000-ton extrusion press with an overall length of 290 feet. The eight-column 35,000-ton die forging presses will be 71 feet high, 51 feet above floor level, and weigh 10,000,000 pounds each, plus an additional 3,000,000 pounds of auxiliary equipment. Castings weighing 450,000 pounds will be required in their construction, and 200,000-pound forgings will form each of the 34-inch diameter, 60-feet-high press columns.

Distributes $200,000 in Bonuses

Goshen Rubber Co., Inc., Goshen, N. Y., distributed a total of $200,000 in bonuses during 1952 to its more than 400 employes. According to President Elmo E. Niccum, the company has had gross sales of between $4,000,000 and $5,000,000 annually for the past few years and has grown to the second largest industrial employer in Goshen. The firm's payroll for 1952 was approximately $1,350,000.

The company is operating on a 24-hour schedule, and the outlook is so favorable that additional employment is anticipated this year. The company also expects to continue its million-dollar expansion program, one-third of which has been completed in the past two years. About 10,000 different types of rubber products, including gaskets, seals, and packings, are made by the firm and sold to some 1,200 customers serviced by 12 salesmen and 14 distributors.

Originally established in 1916 as the Goshen Rubber & Mfg. Co., the firm was incorporated in 1928, reorganized in 1948, and its name changed to its current form in 1949.

Promoted by Nopco

The appointment of George G. Stier as an assistant vice president of Nopco Chemical Co., Harrison, N. J., was announced last month by Thomas A. Printon, president. Stier has been with Nopco since 1932. He will head up the company's lockfoam division, a department recently organized for the development of new uses and markets for a unique foam-in-place plastic material currently sold almost exclusively to the aviation field. He will be responsible also for the handling and negotiation of all military orders and contracts and for the industrial market development department.

Other promotions announced include: Edwin A. Robinson, vice president responsible for textile chemicals and technical director of industrial laboratories; Harry A. Batley, assistant vice president in charge of industrial manufacturing, pilot-plant, and semi-works operations, and plant coordinating; Walter B. Morehouse, assistant vice president, sales manager for the paper chemicals department and supervisor of all industrial division field personnel.

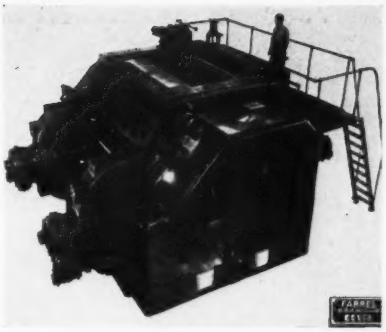
To Erect New Research Lab

Purchase of a 125-acre tract on St. Paul's eastern boundary for a long-range building program for research purposes was announced January 15 by Minnesota Mining & Mfg. Co., St. Paul, Minn.

Plans call for housing many of the firm's major research projects on the tract located at Highway 12 and East Ave.

The first unit in the multi-million-dollar development will be a $3,000,000 laboratory for the company's central research department. Construction of this unit will start this spring and should be completed in the Fall of 1954.

The two-story structure will be built in the shape of an "E" 375 feet long and will contain approximately 100,000 square feet of laboratory and office space. It also will house the company's technical library.



Farrel-Birmingham Z-Type Calender with Four 36- by 92-Inch Rolls

Improved Z-Type Calender

Farrel-Birmingham Co. Inc., Ansonia, Conn., has completed a new Z-type calender equipped with four 36- by 92-inch rolls. Built for a manufacturer of thin vinyl films and intended as part of a complete train, the calender is geared for a maximum production speed of 158.8 yards a minute and is driven by a 700 h. p. D. C. motor. A special design feature of the machine is the arrangement for material feed through the bottom roll pair. This arrangement gives the operator a direct view of the material bank, makes the first pass more accessible for feeding, improves observation of the second pass, and makes access easier to the final pass rolls for starting the material for threading through the cooling train. In addition, the operator can stand directly underneath the top side roll where he can check the action of the pick-off roll and the integral embosser.

The embosser is designed so that its rolls are as close to the last calender roll as possible to minimize heat loss in the material before embossing. A tempering roll is also provided to restore heat to the film before it reaches the embossing roll. The four calender rolls are said to be the heaviest ever installed in a Z-type unit and are made of chilled iron, equipped with high-pressure rotary joints, drilled longitudinally for passage of temperature controlling fluid, and ground to extreme accuracy. A special device is provided for the top side roll to permit adjustments for deflections to suit various film gages in the final pass. Other features of the calender include hydraulic pull-back cylinders on the rolls to eliminate backlash; individual motorized units on each end of the three movable rolls to permit extremely fine roll adjustment; flood lubricating system; variable speed operation from 16-158.8 yards a minute; and herringbone geared Uni-Drive with specially designed universal spindles.

Anchor Plastics Co., custom extruder, recently moved to new quarters at 36-36 36th St., Long Island City 6, N. Y. The firm was formerly at 535 Canal St., New York N. Y.

Bassons Industries Corp., Bronx, N. Y., has copyrighted the name "Plastrong" to designate its reinforced plastics products, according to Arthur Basescu, president.

Mr. Basescu also announced the addition to the company's chemical engineering staff of Walter Greenberg, who will assist George Lubin, director of research.

New Bauer & Black Research Laboratories

Bauer & Black Division, Kendall Co., Chicago, Ill., has announced that construction is under way on new and larger laboratories to house its research and development activities. The new facilities will allow for expanded activity in the fields of biological science for its medical products; physical chemistry on adhesion for its new plastic film and adhesive tape products; and pioneering research in the physico-organic chemistry field. The laboratories will also include a technical service section and related office and service facilities. The building will be of fireproof construction, air conditioned, and of modular construction for ease of installation and future alteration of any laboratory area. In conjunction with these new facilities, the existing quality control laboratories will be enlarged and modernized with the new furniture and equipment. Completion of the new facilities is expected in March, at which time the staff will have been increased 50% with an ultimate addition of 100% as the objective.

1952 Good Year for Ace

A report on 1952 business by Floyd Snyder, president of Ace Rubber Products, Inc., Akron, O., reveals total volume of business up 6% last year, with the greatest December business in the firm's 12-year history. The household products division was especially progressive, showing a 37% gain in the past year.

Mr. Snyder says the rising success of Ace is due largely to a three-point policy of smart styling, alert merchandising, and aggressive selling. He also gives credit to a production plan involving an expanded factory organization and new product development. Establishment of a Canadian subsidiary helped bolster Ace sales in recent months and promises to be an important factor in '53 volume, he added.

Commenting on Mr. Snyder's report, William J. Worrell, sales manager of Ace Rubber, stated that introduction of the Texto Tred line of rubber stair treads and matting, with carpet-like texture, was largely accountable for Ace's great sales increase in household goods. The Waffle Door Mat, a new Oval Mat for kitchens and bathrooms, a Garage Floor Mat, and a new Car-Pet Mat for autos are some of the other new Ace items stimulating sales.

Hardesty Firms Merge

Hardesty Chemical Co., Inc., has been merged into W. C. Hardesty Co., Inc., and will operate henceforth as the Hardesty Chemical Division of W. C. Hardesty Co., Inc. The firm will continue at its present headquarters, 41 E. 42nd St., New York, N. Y.

Howard M. Abbott, vice president of Hardesty Chemical, has been appointed vice president of W. C. Hardesty Co., Inc. Other personnel will continue in their present capacities.

Products of the merged corporation will include its present lines of Century Brand fatty acids and glycerine, together with Harflex plasticizers, sebacic acid, and capryl alcohol.

New Space-Saving Bags for Carbon Black

J. M. Huber Corp., 100 Park Ave., New York 17, N. Y., has announced the development of a new valve-type bag that gives more stable and compact unit load shipments of carbon black with a substantial saving in space. A 2,500-pound unit load of 50 50-pound valve-type bags is only 69 inches high; while a similar load of conventional bags is 84 inches high. Other load dimensions are approximately the same, but total volume of the new style load is 95 cubic feet as compared with 108 cubic feet for the old style. The new bags are also said to stack better in conventional car loadings. The valve-type bags are currently available in carload and truckload shipments of Huber's channel blacks, and development work is in progress at present on a similar package which will be used for the company's furnace blacks.

Midwest Rubber Elections

Midwest Rubber Reclaiming Co., East St. Louis, Ill., on January 9 held its annual stockholders' meeting at which the following directors were elected: Wm. Welch, Stephen G. Luther, Gilbert K. Trimble, T. W. Pettus, J. M. Olin, H. W. Kroeger, and R. R. Semler. The board at its meeting then elected the following officers: chairman, Mr. Welch; president, Mr. Kimble; vice president, Mr. Luther; executive vice president and treasurer, Howard R. Painter; secretary and assistant treasurer, Wm. Baker; assistant secretaries, Harry H. Harris and Harold R. Stuteville.

Midwest Rubber Reclaiming also announced personnel changes involving the employment of Charles D. Smith as chief engineer and the appointment of Mr. Semler as resident manager of the Barberton plant.

The latter started with the predecessor company, Akron Rubber Reclaiming Co., and worked on the original design, layout, and construction of the East St. Louis plant with S. G. Luther. Since that time he has been superintendent of the Barberton plant, factory manager for both plants, chief engineer for the company and now returns to Barberton as the resident manager there.

Mr. Smith was formerly assistant division engineer for the Springfield, Mass., plastics division of Monsanto Chemical Co.

History of Fire Hose

John Royle & Sons, Paterson 3, N. J., gives an interesting story on "The Evolution of Fire Hose" in the January 15, 1953, issue of its publication, *The Royle Forum*. The development of water-carrying equipment for fire fighting is described from biblical days up to the present, with numerous illustrations used to point up some of the early advances. Highpoints in the evolution of present-day fire hose include the development of leather hose in 1672; the introduction of fabric hose in the late 1850's; the invention of rubber-lined cotton hose in 1868; and the invention of the original DeLaski circular hose loom, now sold in improved form as the Royle circular loom, in 1887.

Firestone Making Jet Engine Parts

Once the largest manufacturer of stainless steel milk cans and beer barrels, Firestone Tire & Rubber Co., Akron, O., has now converted its facilities to the production of such hot parts of jet aircraft engines as turbine casings, inner and outer combustion chambers, and exhaust cone assemblies. Firestone Steel Products Co. is said to be the largest fabricator of stainless steel in the country and during the last war produced shatterproof oxygen cylinders for high-altitude planes.

Scholarship Awards

A scholarship award program for children of Firestone employes throughout the United States has been announced by Harvey S. Firestone, Jr., board chairman. Each award will pay the costs of full tuition, fees, and books and also contribute toward living expenses. The scholarships will be awarded to 15 high school graduates each year so that, after four years, the company will be financing 60 students annually. Scholarship winners may attend any accredited college or university and will be given aid until they receive a degree provided they maintain satisfactory records.

To be eligible for a Firestone scholarship, a student must be in the upper half of his class and be the son or the daughter of a Firestone employe who has completed five years of service with the firm as of June 1, 1953, or who had more than five years of service at the time of death or retirement. All applications will be reviewed and passed on by an outside group, the Firestone Scholarship Committee, with H. E. Simmons, president emeritus of the University of Akron, as executive director.

Scholarships will be allocated to various sections of the country on the basis of proportionate employment. Only children of employes whose average base pay does not exceed $625 a month will be considered for scholarship awards. The deadline for all applications is April 1, and winners will be announced early in June.

Changes at Baird Rubber

Robert B. Baird, grandson of one of the founders of Baird Rubber & Trading Co., Inc., 233 Broadway, New York 7, N. Y., has assumed the duties of Harold W. Holcombe, who resigned recently as vice president.

Another resignation is that of Wm. A. Person, who has returned to the aviation industry, with which he had been previously engaged for a number of years.

Paul A. Mulach has joined Baird in a sales executive capacity. He was formerly vice president and general manager of Institutional Services, Inc., Brooklyn.

L. E. Lundberg has been named assistant general credit manager of The Goodyear Tire & Rubber Co., Akron, O. Lundberg joined Goodyear in 1924 at Boston, Mass. He later was made operating manager at Albany, N. Y., and also served as district credit manager in Boston prior to being assigned as division credit manager at Akron in 1935.

G-E Expands Silicone Facilities

General Electric Co., Pittsfield, Mass., has announced that expanded facilities for the manufacture of silicone materials were placed in operation at the company's Waterford, N. Y., plant on January 15. This expansion, costing more than $5,000,000, is said to give the firm a silicone production comparable to any in the country. Laboratory services have also been doubled, and employment is up 50% from that of a year ago. According to Charles E. Reed, general manager of the silicone products department, demand for silicone rubber by aircraft and automotive manufacturers alone has trebled in the past two years. The current expansion and even larger facilities now being planned will prepare G-E for an expected tenfold increase in total industry demand for all silicone products by 1960.

Paisley Acquires Hayes

Hayes Adhesives Co., St. Louis, Mo., adhesive firm, became an affiliate of Paisley Products, Inc., Chicago, Ill., (division of Morningstar, Nicol, Inc.) by direct purchase on January 5. The purchase included the assets of the firm, formulae, manufacturing processes and equipment at three separate locations in metropolitan St. Louis. The Hayes plants will be operated as an affiliate of Paisley Products, whose operations have outgrown present Chicago facilities. A large portion of its manufacturing will be transferred to the newly acquired plants.

Vernon Hayes, former head of Hayes Adhesives Co., will continue as local manager of the St. Louis plants. He will direct an expanded sales staff to bring improved distribution of the combined Hayes-Paisley line to an enlarged southern and southwestern territory.

The Hayes firm, established in 1932, as a partnership, by Vernon and Gerard Hayes, occupies more than 100,000 square feet of manufacturing space, devoted to industrial and decorative adhesive materials. Products include mastic cements and adhesive bonding agents for acoustical tile, floor and wall coverings. The industrial line, augmented by the Paisley series of products, will go to paper mills and converters, paper box manufacturers, food packaging firms, luggage, woodworking plants, printers, bookbinders and other industries.

The overall supervision of Hayes Adhesives will be assumed by Murray Stempel, executive vice president of Morningstar and general manager at Paisley, from his headquarters at Chicago. Earl C. Lenz, vice president and general sales manager of Paisley operations, will direct the combined sales staffs. Technical direction of laboratories and plants will be handled by Sam Schuller, who is a Paisley vice president.

Removal Notice

The New Jersey Zinc Sales Co., Inc., 160 Front St., New York 38, N. Y., has moved its San Francisco, Calif., office to 1495 Custer Ave., where C. E. Mayerhauser is now in charge. He had been assistant to R. W. Munson, who has been transferred to the New York office.

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STATEX-M

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MANUFACTURER DISTRIBUTOR

Harmon Color Now Part of Goodrich Chemical

Harmon Color Works, a division of The B. F. Goodrich Co., Akron, O., became a part of B. F. Goodrich Chemical Co., Rose Bldg., Cleveland, O., February 1, according to John R. Hoover, president, Goodrich Chemical.

Orville E. Isenburg, formerly international sales manager for Goodrich Chemical, has been appointed sales manager for Harmon colors. The Harmon sales staff, which serves a variety of manufacturing industries throughout the United States and abroad, will be under Isenburg's direction.

Victor Chartrand, formerly president of Harmon will join the Goodrich Chemical organization in an advisory capacity in the field of organic color sales.

Manufacturing and technical activities for Harmon colors will continue under the direction of H. T. Madden and Vincent Vesce, respectively.

Harmon organic colors will continue to be manufactured at Haledon and Kearny, N. J., Hoover said, and sales headquarters will be in Cleveland, at the general offices of Goodrich Chemical, 2060 E. Ninth St.

Harmon Color Works was purchased by The B. F. Goodrich Co. in 1950. The Harmon product line— organic color pigments— is closely allied to several Goodrich Chemical product groups, Hoover observed, and fits into the company's operations from the standpoint of development, production, and marketing.

New High-Speed Tube Process for GR-S

Early in January, John L. Collyer, president of The B. F. Goodrich Co., Akron, O., announced the development of a new, lower-cost process for making LTP GR-S in 15 to 20 minutes instead of the 10 to 12 hours now required with present production methods. He said that the new process, developed by B. F. Goodrich Chemical Co., a division of B. F. Goodrich, is the result of 12 years' research by company scientists, and that it had been perfected under a research contract financed by the Office of Synthetic Rubber, Reconstruction Finance Corp.

Under this new method, still in the pilot-plant stage, rubber is made in stainless steel pipes rather than in expensive pressure vessels employed in the present government-owned plants. The small size and the simplicity of construction for the new process eliminate the need of much expensive equipment and reduce the size of the building required to house the rubber-producing operations. Cost of buildings and equipment could be reduced at least 50% with the new process, it is said.

The continuous pipeline process was made possible by the development of extremely active catalysts which speed up the reaction for making American synthetic rubber. Goodrich has successfully made specialty rubbers at higher temperatures by the pipeline process in pilot plants since early 1947.

The new process cannot be used in existing synthetic rubber plants because of insurmountable technical problems, and this point raises the question of the possible obsolesence of present facilities.

"The new faster process apparently offers unlimited opportunity for the production of improved rubbers at lower costs, progress of interest to all users of tires, and many other products in which American rubber is used," Collyer said.

Claude Pitts

Pitts Succeeds Waite

Claude Pitts has been named vice president and general manager of Seiberling Rubber Export Co., Akron, O. He succeeds Harris A. Waite, who has retired after 24 years' service, according to L. M. Seiberling, president of the export company and vice president in charge of sales for Seiberling Rubber Co., the parent organization.

During his career in the export business Waite lived or traveled in 57 countries. He was with the export department of the Goodyear Tire & Rubber Co., was at one time managing director of Goodyear Tyre & Rubber Co. of India, Ltd.; assistant export manager of The B. F. Goodrich Co.; and export manager of Mennen Co., before joining Seiberling in 1928.

Pitts came to Seiberling as assistant export manager in May, 1951. Previously he had been with Borg-Warner Corp. for 17 years, serving as assistant export manager of the Norge division and later as general product manager of Borg-Warner International Corp. In his new position he will supervise Seiberling's export sales in 66 foreign countries.

Timken Production Record

While praising the teamwork and cooperation of employes, A. M. Donze, vice president of The Timken Roller Bearing Co., Canton, O., announced that an all-time production record was achieved at Timken plants during November, only to be exceeded during December. Donze said that 242,000 finished bearings were produced for each working day during November. During December, 250,000 finished bearings were produced for each day worked.

Commenting on business and production prospects for 1953, Donze said that a considerable backlog of orders existed, and production would continue at a high level well into the new year.

Bolta Shows New Vinyl Wall Covering

Bolta Product Sales, Inc., Lawrence, Mass., manufacturer of Boltaflex plastics upholstery, held a press preview for a new surface-textured and easy-to-install vinyl wall covering, at the Biltmore Hotel, New York, N. Y., January 20. Developed for home, business, and institutional use, the wall covering is available either as eight-inch-square Bolta Wall-Tile or as Bolta-Wall in rolls.

In two attractive new surface textures—bamboo and leather-grain finish—the material is available in a wide variety of colors including light pastels. Bolta Wall-Tile, however, is available at present only in the bamboo pattern. This semi-flexible wall covering consists of an outer layer made of Vinylite resins laminated firmly to a rubber-saturated paper backing. Bolta-Wall Adhesive #571 is used to apply the covering to the wall. Bolta-Wall is supplied in standard rolls 48 inches in width and 25 yards long.

Bolta Wall-Tile may be applied by home owners with the help of a home installation kit complete with all necessary tools, and an instruction manual.

In developing this new wall covering Bolta Products overcame the staining usually caused by the presence of sulfur in the air or in water by the use of a lead-free stabilizer, which also increased the fading resistance of the material.

Bolta plans to market Bolta-Wall in roll form through regional distributors, who will establish a number of franchised dealer-applicators in the specialty floor covering field.

Columbia-Southern Joins Silicate Institute

Columbia - Southern, Chemical Corp. Pittsburgh, Pa., has become the fifth nationally known firm to join in support of the Graduate Institute in Silicate Chemistry and Related Sciences at the University of Toledo, President Asa S. Knowles announced on January 21. A pledge of $15,000 over a five-year period brings the total support of the Institute to $165,000.

Dwight R. Means, vice president, Columbia-Southern, disclosed the action by the company. J. A. Neubauer, technical director of the company, has been nominated as representative on the technical advisory committee of the Institute.

The Institute was organized in July, 1952, and is devoted to basic research and instruction in the silicate field—glass, refractories, ceramics and porcelain, hydraulic binders, and mineral synthesis. Its director is Wilhelm Eitel, an international authority on silicate chemistry and founder of the Kaiser Wilhelm Institute of Silicate Research in Berlin-Dahlem, Germany, where he was director for 25 years.

George W. Sharpe has been appointed manager of promotion, merchandising, and sales for Victory Plastics & Embossing Corp., Brooklyn, N. Y. Mr. Sharpe, whose office will be at 172 Madison Ave., New York, N. Y., was formerly vice president and director of sales at Prepac, Inc., and from 1944 through 1950 had served as promotion and merchandising director at Richard, Boggs & King.

United States Rubber Promotes Several

United States Rubber Co., Rockefeller Center, New York 20, N. Y., recently announced sales management promotions in its footwear and general products division.

Louis J. Healey, has been made sales manager of general products. Arnold H. Finnern succeeds Mr. Healey as Pacific Coast sales manager.

Mr. Healey will make his headquarters in the Providence, R. I., plant of the company where many of the products under his sales direction are produced. He started with U. S. Rubber in 1939 as a sales clerk in the San Francisco branch and became a salesman in 1940. From August, 1941, to February, 1946, he served with the United States Navy and on his return to the rubber company was appointed assistant to the San Francisco district manager. The following year he was made district sales manager of the branch and in August, 1948, Pacific Coast sales manager.

Mr. Finnern began with the rubber company in 1937 as a sales clerk in the San Francisco branch. Progressing through sales, he was appointed district sales manager of the Los Angeles branch in 1943.

R. H. Slate, since 1944 district sales manager of the Seattle branch, is now district sales manager of the Los Angeles branch. Mr. Slate started with the rubber company in 1929 as a clerk at Los Angeles. After several promotions he was appointed district sales manager of the Denver branch in 1939.

Leslie W. Whittington, assistant sales manager at Los Angeles, has been made district sales manager at Seattle. Mr. Whittington went to work with the company in 1939 as a stock clerk in Portland, Oreg., later progressing to sales management positions.

Five new assignments in the electrical wire and cable department were announced last month by Howard H. Weber, sales manager of the department.

John Blake has been made manager of state and municipal sales; and E. T. Corbus, manager of electrical utilities sales. Both are at U. S. Rubber's headquarters in Rockefeller Center.

J. W. Loveland, at the New York branch at 191 Hudson St., is now eastern division sales manager, succeeding Mr. Corbus.

C. R. Pickens will be the southeastern division sales manager, at Atlanta, Ga., and H. J. Cluver will be the middle-Atlantic division sales manager, with headquarters at Philadelphia, Pa.

Wrightnour and Kelley Advanced

William F. Wrightnour has been appointed assistant to the vice president and general manager of the tire division, U. S. Rubber; while Patrick H. Kelley has been made director of training for the division, succeeding Mr. Wrightnour.

Besides his new responsibilities Mr. Wrightnour will continue to be responsible for the coordination of the division's management development program. He entered business as a distributor of U. S. Royal Tires. Subsequently he joined the rubber company and after several assignments rose to manager of sales training and then to director of training for the tire division.

Mr. Kelley's new position embraces management training, sales personnel and training, plant training, and distributor training. After graduating from Niagara University, he taught for several years and then joined the Naugatuck Chemical Division of U. S. Rubber at Naugatuck, Conn., where he was supervisor of training and safety and later manager of industrial relations. In 1946 he switched to the tire division. Mr. Kelley was personnel representative, then supervisor of sales personnel administration, and until recently assistant director of training.

Sawyer Now Development Manager

Fred A. Sawyer has been made development manager of the company's footwear and general products division, to succeed George Blair, who will soon retire after more than 41 years of service with the company.

Mr. Sawyer, who will make his headquarters in the Mishawaka, Ind., plant, started with U. S. Rubber in May, 1939, as a sales engineer in automotive sales. Later responsibilities included extensive engineering and sales work with foam rubber, fuel cells, automobile mats, and other automotive products. During World War II he was active in the development and sale of storage tanks for gasoline, water, and oil and in other important war projects. Early in 1946, Mr. Sawyer was named manager of development sales in the footwear division and in July, 1947, manager of the new plant in Chicago. While there he also pioneered in the sale of Royalite thermoplastic parts for automotive use. In October, 1949, Mr. Sawyer became manager of automotive sales for the footwear division's products, transferring his headquarters to Detroit. Less than three years later he was appointed assistant development manager of the footwear and general products division.

New Uskon Heating Panel

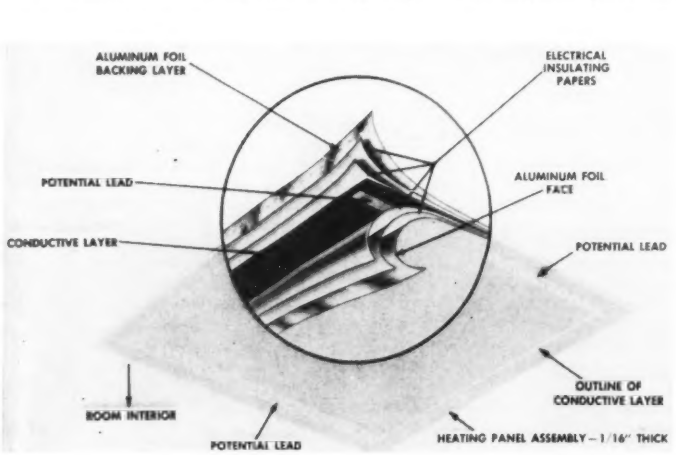
U. S. Rubber at a luncheon on January 12 at the St. Moritz Hotel, New York, announced and demonstrated a new electrical radiant heating panel to the business and trade press. The new panel is a sheet of conductive rubber that is the heating unit, sandwiched between layers of electrical insulating paper and aluminum foil.

Complete radiant heating for the entire house or a single room is possible with the panels, which are only 1/16-inch thick and can be cemented to the ceiling like wallpaper. The panels, called Type T Uskon, are extremely light, weighing only six ounces per square foot. They are bonded to ceilings of plaster, sheetrock, or similar smooth material by means of a special adhesive. The number of panels required is determined by climate, insulation, and other factors, but, generally, Uskon does not cover the entire ceiling.

Where electricity is available for 1½¢ a kilowatt hour or less, the cost of operation is comparable with that of other fuels.

Three sizes of panels are available, four by six feet, four by four feet, and three by four feet, and both outer surfaces are covered by aluminum foil to keep out moisture. The panels are rate at 22 watts per square foot (75 BTU's) and are available for either 115 or 230 volts. Surface temperature of the ceiling panels averages about 100° F., and the heat rays from the panel warm the floor and other objects in the room, without heating the air. Individual room heating may be operated by thermostatic control, if desired. Panels can be attached to ceilings without any cutting, rebuilding, plastering, or structural changes. The panels are painted with conventional flat interior decoration.

Installation costs average around $40 for each four by six panel in supplementary heating applications; for a complete house initial costs would be cut to about $35 a panel.



A Typical Type T Uskon Panel

Names Satusply Distributor

U. S. Rubber on January 14 appointed New York Metal Moulding Co., Inc., a distributor of Satusply in the states of New York, New Jersey, Connecticut, Rhode Island, and Pennsylvania as far west as Harrisburg. Satusply is a hard surface plastic top covering, with an adhesive on its gluing surface for ease of installation, in covering table tops, sink tops, counters, and other flat surfaces.

New York Metal Moulding will carry complete stocks of Satusply in New York and Philadelphia, as well as in Newark, N. J., where it operates under the name of N. Y. Metal Products, Inc.

The new distributor plans to set up linoleum stores, hardware stores, and lumber yards as dealers of the plastic topping material. Dykes Lumber Co., New York, is announced as the first dealer.

Engages Fabric Stylist

Miss Darleen Smith has been engaged as stylist for U. S. Royal fabrics, the consumer fabrics line of U. S. Rubber's textile

division. Her appointment is a further step in the expansion of the company's production of consumer fabrics, stated Woodrow D. Johnson, merchandise manager of consumer fabrics. Miss Smith will be responsible for styling U. S. Royal apparel and home decorating fabrics.

Miss Smith joins the company after three years of fabric development and color styling for C. M. DeLand. Last year she spent three months in Europe studying the Paris couturier collections and new fabrics. Previously Miss Smith for three years had been market fabric coordinator for A. M. Tenney Associates, now a division of Tennessee Eastman Corp. Her prior experience included retailing and fashion work with leading New York department stores.

She will headquarter at the U. S. Royal Fabrics office, 1407 Broadway, New York.

Goodyear's New Polyester-Type Synthetic Rubber

Goodyear Tire & Rubber Co., Akron, O., through P. W. Litchfield, chairman of the board, has announced a new polyester-diisocyanate rubber, similar to the German Vulcollan rubber. Tensile strength of the new rubber is described as 50 to 100% better than other types of rubber-like material; vulcanization time on tires made with it can be cut more than half, and products can be made in every color of the rainbow. Tire treads wear from two to five times better than those of cold GR-S rubber, when made with the Goodyear polyester rubber; it is equivalent to butyl rubber in air diffusion resistance and is equivalent to neoprene in oil resistance, it is further claimed.

The promise of the new synthetic rubber lies in its greatly increased toughness and resistance to abrasion. The problems to be overcome before the new product can find wide use are in the areas of economic production of the raw material, the development of processing methods, and in the improvement of its present qualities of resilience and adhesion. Litchfield expressed optimism for the solution of these problems, but added that in the foreseeable future the nation must continue to look to its GR-S facilities for the greater part of its general-purpose synthetic.

R. P. Dinsmore, Goodyear's vice president in charge of research and development, said that the new Goodyear rubber differed from the German Vulcollan in that the solidifying reaction of the polyester with the diisocyanate can be controlled at a point where the resultant material can be further processed on mills, calenders extruders, and other conventional rubber equipment.

When needed in production, the Goodyear rubber is given another diisocyanate treatment and formed into final shape without the use of sulfur or accelerators for vulcanization. Carbon black and other reinforcing agents may be used, although not required as a stock-toughening material.

E. J. Fitzpatrick, president, Industrial Tape Corp., has been elected a director of Johnson & Johnson, both of New Brunswick, N. J.

Kralastic Tested in Water Meters

Kralastic, a tough plastic made by Naugatuck Chemical Division, United States Rubber Co., New York, N. Y., is undergoing extensive field testing as a substitute for bronze in water meter register boxes and covers by Worthington-Gammon Meter Division, Worthington Corp., Newark, N. J. Developed in conjunction with Shaw Insulator Co., which is injection molding the plastic parts, the new meters are being tested in every section of the country. Work was initiated on the project some two years ago as the result of the chronic copper shortage, and various metals and plastics were tested to replace the bronze parts in the meters. Laboratory tests showed Kralastic to be comparable to bronze in service, and, if substantiated by the field tests, the Kralastic register box and cover will become standard on the meter.

Changes at Raybestos

John F. D. Rohrbach, president of Raybestos-Manhattan, Inc., Passaic, N. J., has announced that at a meeting, January 21, the board of directors made the following appointments.

W. Ward Kievit is new treasurer, succeeding the late George R. Weber. Mr. Kievit, who is also comptroller and a director, joined Manhattan Rubber Division in 1917 and held the office of chief accountant, auditor and secretary previous to his election as comptroller.

William S. Simpson has been made general manager of Raybestos Division, Stratford, Conn., to succeed Robert B. Davis, retired. Mr. Simpson, also secretary and a director, joined the division in 1939 in the sales promotion department. He has been director of personnel and assistant general manager of the division.

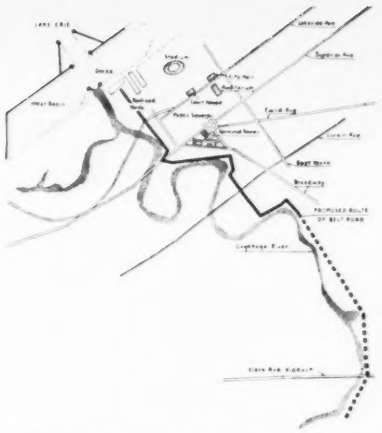
Osborn H. Cilley is now general manager of U. S. Asbestos-Grey-Rock Division, Manheim, Pa., replacing Mr. Weber. Mr. Cilley, also a vice president and director, joined the Manheim organization in 1920 as plant superintendent and became assistant general manager in 1928.

S. R. Zimmerman, Jr., has been appointed assistant general manager at the Manheim plant. He started with that division in 1932 as industrial engineer and was assistant sales manager and manager of automotive and industrial equipment sales for the division and director of friction material research and development for the corporation.

Foxboro Wichita Branch

The Foxboro Co., Foxboro, Mass., manufacturer of industrial instruments for measurement and control, has opened a new branch office at Wichita to serve instrument users in the Kansas area. Located at 2207 South Pinecrest, the new branch brings the Foxboro total to 42 offices within the United States, reflecting the growing demand for instrument engineering in all phases of industrial processing.

Appointed resident engineer at the Wichita office is Dale G. Hugley, who moves to his new assignment after several years of service with the Tulsa branch as industrial engineer.



Drawing of a Possible Route for Proposed Conveyor Beltroad through Cleveland

Propose Conveyor Beltroad Through Cleveland

A rubber conveyor beltroad to transport iron and limestone from the Lake Erie harbor to industrial processors in the Cuyahoga Valley has been proposed as a solution to Cleveland's perennial problem of keeping the narrow, twisting Cuyahoga River open to ore boat traffic. After studying the problem for more than a year, engineers of The B. F. Goodrich Co., Akron, O., believe that such a beltroad stretching 4½ miles up the Cuyahoga Valley could be built in a year at an estimated cost of $6,000,000 for conveyor and drive equipment and not including dock unloading facilities and rights of way.

In a report recently presented to the Cleveland Port & Harbor Commission by John M. Cooney, Akron district manager of industrial products sales for Goodrich, it is proposed that the conveyor belt system could accept iron ore and limestone directly from ships docking at new waterfront facilities. Cargoes could also be unloaded into a stockpiling area at the same location. The main beltroad would then provide a smooth, continous flow of materials from lake front to steel plants; while spur lines would carry materials from the main beltroad to individual users. The proposed system would eliminate the time-consuming river passage of the ore boats; allow for more frequent deliveries to the Cleveland area; relieve traffic congestion in the city by eliminating the need of constant opening and closing of the many bridges along the river; reduce the smoke nuisance in Cleveland; and permit quicker repair in case of enemy attack.

Bernard P. Rothermel has become manager of commodity costs at B. F. Goodrich Plant 4, in Akron, replacing **Fred Foss,** retired. Rothermel, with the company 26 years, started in the billing department, later moved to corporate accounts, and also served in the credit section of International BFG's export division. In 1942, Rothermel went to Texarkana, Tex., to head up the accounts payable department of the Lone Star shell loading plant operated for the government by Goodrich. In 1947, he returned to Akron on special assignment with the commodity cost department.

Roy C. Murphy

Corduroy Rubber Elections

At a special meeting of the board of directors of Corduroy Rubber Co., Grand Rapids, Mich., December 23, Roy C. Murphy, executive vice president, was elected president to succeed the late L. A. Brown. Murphy started with the firm in 1921 as purchasing clerk and by 1929 was a director. In 1931 he became executive vice president and in 1943 treasurer and general manager. In 1932 he was instrumental with his associates in developing the mechanical rubber goods division of the company.

Charles E. Mills, factory manager, was elected vice president and director at the meeting. He formerly had been with a major tire manufacturer as technical superintendent in South America and later as assistant chief chemist at Los Angeles, Calif.

Malcolm S. Bonney, director of purchases, was elected treasurer. He has been a director of the company for five years. He entered Corduroy's employ as a tire builder, advancing rapidly to shipping clerk, assistant bookkeeper, and eventually purchasing agent.

These men constitute the board of directors, with Leo B. McCourt and Joseph Stevens, Jr. McCourt started with the firm as service manager 28 years ago and is now sales manager of the tire and tube division. He was elected director and secretary in 1943. Stevens is a Grand Rapids business man.

Erie Foundry Officers

At a recent directors' meeting of Erie Foundry Co., Erie, Pa., D. A. Currie resigned as president of the company to become chairman of the board. He will continue, however, as treasurer.

New president is James A. Currie, formerly first vice president.

Lysle F. Walker, who has for years been in charge of purchasing, was elected a vice president. He now also is director of purchases.

At the same time Orin C. Owens was named assistant secretary.

Macdonald C. Reed continues as vice president; while C. D. Pinney remains secretary and assistant treasurer.

The present directorate of Erie Foundry includes F. F. Clark, Henry A. MacDonald, Mr. Reed, and both of the Curries.

Kimball Back with General

Dan A. Kimball, who resigned, January 21, as Secretary of the Navy was reelected on January 6 a vice president and member of the board of directors of The General Tire & Rubber Co., Akron, O.

Board Chairman W. O'Neil also announced, at the board meeting, the resignation of Lewis L. Strauss who has been a director since August 21, 1950.

Kimball returns to General after nearly four years of government service. On March 9, 1949, he resigned as a vice president and a director to become Assistant Secretary of the Navy for Air. Two months later he was named Under Secretary of the Navy. For the past year and a half Kimball served as Secretary of the Navy.

A member of the General organization since 1919, he held the position of western division sales manager for 18 years before being appointed in 1941 manager of the government relations department. During World War II, Kimball was assigned to head the Aerojet Engineering Corp., a General subsidiary and large manufacturer of JATO (jet-assisted-take-off units) and solid and liquid fuels for jet propulsion.

Dan A. Kimball

He was named vice president in charge of special operations in 1946 and a director in 1948.

He will headquarter at General Tire's home offices in Akron.

Harwick Handling General Tire's Chemicals

Harwick Standard Chemical Co., 60 S. Seiberling St., Akron 5, O., has been appointed sales agents by The General Tire & Rubber Co.'s chemical division for the sale of Actogen accelerator-activator; Ko-Blend I. S., a latex compound sulfur masterbatch; and Gen-Tac Resin for improving adhesion of fabric dips. Harwick's territory will comprise the United States, except for the Pacific Coast, and all of Canada. General Tire will continue to make all shipments and issue invoices, but all future orders and requests for samples or information should be addressed to Harwick at 901 Broad St. Bank Bldg., Trenton 8, N. J.

Discontinues Dipped Goods

Dewey & Almy Chemical Co., Cambridge, Mass., on January 9 announced that in order to concentrate its efforts within the rubber specialties division on government orders for meteorological balloons, it has decided to withdraw from the manufacture of dipped rubber consumer and industrial items upon completion of orders now on hand. The market for these items is limited, and the nature of the business does not fit in with the company's plans for future growth.

Mott and Curran in New Assignments

Retirement of William F. Mott as sales manager, shoe products division, and promotion of George L. Curran to field sales manager were announced January 13 by T. T. Miller, vice president in charge of marketing.

Mr. Mott, under doctor's orders to curtail his hours of work and travel, will continue through 1953 as assistant to the manager to the division, acting as consultant on advertising and promotion plans. He has been with Dewey & Almy since 1930.

Mr. Curran, as field sales manager, will supervise sales of Darex insole materials, plumpers, weltings, and other shoe components through district representatives and directly with customers. Mr. Curran joined the company in 1949 as consumer products manager of the rubber specialties division.

Changes at Calco

Calco Chemical Division, American Cyanamid Co., Bound Brook, N. J., last month reported two sales executive changes.

Rupert W. Daniels has been appointed manager of intermediate sales. Since coming to Calco in 1936, he has been identified with all phases of development, production, purchasing, and sale of coal-tar products and intermediates.

Philip G. Connell, Jr., has been made assistant manager of rubber chemicals sales. Joining Calco in 1946 as a student trainee, he worked in the production and development departments prior to his promotion to the intermediate and rubbber chemicals sales department.

Rupert W. Daniels

Stratosphere Test Chamber

Tenney Engineering, Inc., Newark, N. J., has designed and built a special 440-cubic foot environmental test chamber for Goodyear Aircraft Corp., Akron, O., to use in testing finished products, components, and materials. The chamber produces temperatures ranging from —100 to +200°F., humidities from 20-95%, and vacuum pressures from atmospheric down to one inch of mercury absolute (corresponding to an altitude of 75,000 feet). The chamber is engineered to go from room temperature down to —100°F. in 90 minutes when containing a mass of 1,000 pounds, and pressure can be brought down from atmospheric to one inch of mercury in 20 minutes.

In addition to provisions for independently varying temperature, humidity, and pressure, the chamber is equipped with two 3,000 rpm. power shafts and two terminal pads so that mechanical and electrical energy may be brought in for testing equipment under actual operating conditions. Ceiling studs provide for future installation of a monorail conveyor. Automatic controls make it possible to conduct tests under cycled weather conditions.

The walls, roof, and floor of the chamber are reinforced with 10- and 12-inch channels to withstand operating vacuums. The completely removable door forms an end wall of the chamber and is trolley mounted on an overhead beam. The door seats against a seal, is strapped in place with vertical channels, and drawn tight by compressed air cylinders. The interior walls are lined with stainless steel panels, and all joints are vapor sealed. Refrigeration is provided by four compressors hooked up in a three-stage system; while heating is accomplished by means of electric elements in a housing on the back of the chamber. Four fans above the heaters are used to circulate air. Relative humidities are controlled by introducing water vapor into the air stream, or by condensing water from the chamber atmosphere. A 15-h.p. pump is used for creating vacuums. All controls are mounted on an outside panel.

M. W. Kellogg Co., Jersey City, N. J., has established new warehousing facilities for Kel-F plastic in Vernon, Calif. According to Louis C. Rubin, manager of the company's chemical manufacturing division, the new facilities will handle orders for Kel-F molding powders in California, Oregon, Washington, Arizona, Nevada, and Utah.

Emil O. Jensen has been elected vice president and general sales manager of Roth Rubber Co., Chicago, Ill. He has been with Roth since 1950.

Armed Services Textile & Apparel Procurement Agency, 111 E. 16th St., New York 3, N. Y., recently announced the awarding of the following contracts for: *men's high rubber overshoes,* to United States Rubber Co., Naugatuck, Conn., 48,000 pairs, valued at $159,574.68; *knee boot waders,* U. S. Rubber, 9,000 pairs, $60,210; *solvent-resistant rubber gloves,* The Pioneer Rubber Co., Willard, O., 1,675 pairs, $2,050.55; *acid-resistant rubber gloves,* U. S. Rubber, Providence, R. I., 33,600 pairs, $37,759.70.

Reelects Officers

All directors of The Firestone Tire & Rubber Co. were reelected January 17 at the annual meeting of stockholders in Akron, O., including Harvey S. Firestone, Jr., Lee R. Jackson, John J. Shea, James E Trainer, Raymond C., Leonard K., and Roger S. Firestone, Harvey H. Hollinger, and Joseph Thomas.

At the board meeting following, all officers were reelected, and H. M. Taylor was elected vice president, manufacturers sales. Officers are: Harvey Firestone, chairman; Mr. Jackson, president; Mr. Shea, vice president, finance; Mr. Trainer, vice president, production; Harold D. Tompkins, vice president, trade sales; Raymond Firestone, vice president, research; Mr. Hollinger, treasurer; Mr. Thomas, secretary and general counsel; Claude A. Pauley, comptroller; Elton H. Schulenberg and Wm. D. Zahrt, assistant treasurers; Henry S. Brainard, assistant secretary; and Timothy Doyle and Laurence A. Frese, assistant comptrollers.

Robert Badenhop Corp., formerly at 233 Broadway, New York 7, N. Y., is now settled in its new offices on the entire twenty-ninth floor of 21 West St., New York 6.

NEWS ABOUT PEOPLE

H. M. Taylor

H. M. Taylor was elected vice president, manufacturers sales, of The Firestone Tire & Rubber Co., by the directorate following the annual stockholders meeting in Akron, January 17. He is in charge of all tire sales to the manufacturers of automobiles, buses, trucks, tractors, farm implements, and earthmoving equipment throughout the United States. Mr. Taylor joined Firestone in May, 1915, on the wholesale sales force in Detroit, Mich. During World War I, he served in the U. S. Navy and returned to his sales position with the company in January, 1919. He became a member of the manufacturers sales staff in 1921 and has been connected with that department ever since. In 1926 he was made manager of the Detroit office of the department and in 1944 moved to Akron as manufacturers sales manager.

Evert Pearcy has been appointed eastern sales representative of Indoil Chemical Co., with headquarters in New York. Mr. Pearcy was formerly with Sid Richardson Carbon Co.

Harold Lorenz has joined the sales staff of Indoil, with headquarters in Chicago, Ill. Mr. Lorenz comes from Westvaco Chemical Division.

D. Alwyn Stivers, formerly of Goodyear Tire & Rubber Co., is the new chief chemist for Ace Rubber Products, Inc., Akron, O. Mr. Stivers was engaged in development and compounding for several years and served an assignment to install a laboratory for the Goodyear plant in South Africa. Having most recently specialized in mechanical goods compounding, Mr. Stivers was particularly selected for his post with Ace Rubber, which manufactures automotive and household items, including the new Texto Tred group.

Hugh Puckett, since 1938 southern district manager of industrial chemicals division, has been named manager of specialty products department of American Cyanamid Co., Rockefeller Center, New York 20, N. Y. Puckett has been associated with the chemical industry since 1922 and for the past 25 years, with Cyanamid's industrial chemicals section. He represented Cyanamid first as assistant southern sales manager and then as southern sales manager. He will continue his headquarters at the Charlotte, N. C., offices of American Cyanamid.

Sam Dupree, since 1947 assistant manager of the industrial products division of The Goodyear Tire & Rubber Co., Akron, O., has been named assistant to R. S. Wilson, vice president in charge of sales. Dupree's new position places him as Wilson's liaison executive with the company's industrial products, shoe products, chemical and steel products division. Dupree joined Goodyear at Akron on January 1, 1934, in the production training squadron. After a few months he transferred to mechanical goods development; in 1939 was named development manager at the new molded goods plant then starting at St. Marys, O.; became sales manager there in 1945, and returned to Akron in 1947.

Roger E. Vaughan has been appointed assistant general manager of Consolidated Machine Tool Corp., Rochester, N. Y., subsidiary of Farrel-Birmingham Co., Inc., Ansonia, Conn. Mr. Vaughan has been assistant general manager of the Farrel-Birmingham plant at Buffalo, N. Y., since 1943. He joined the company in 1936.

Thomas D. Bolt has been added to the staff of the research and development department of Godfrey L. Cabot, Inc., Boston, Mass., carbon black manufacturer. Mr. Bolt was formerly with Gates Rubber Co., Denver, Colo. His new duties will involve applications research and technical service compounding in conjunction with the application of Cabot carbon black products in rubber and rubber-like materials.

Fred T. Marshall has been named director, federal government relations, of The B. F. Goodrich Co., Akron, O., with headquarters in Washington, D. C. Marshall, with Goodrich for 34 years, has been in Washington for the company since 1944 as a government sales and field sales representative and has been Washington district manager of the company's automotive, aviation, and government sales division since 1947. During his career with Goodrich, Marshall has been an aeronautical sales representative for that division in Washington; general sales supervisor in Philadelphia; and has held various executive sales positions in the Chicago district.

Marcus W. Keyes has been appointed to the new position of sales engineer for Pittsburgh Plate Glass Co.'s fiber glass division. During the past 12 years Mr. Keyes was with Kimberly-Clark Corp. as product development engineer. Earlier he had served as sales manager for the insulation division of General Heat & Appliance Co and with Johns-Manville Corp. as manager, acoustical construction.

James J. Meenan has been appointed manager of the rubber department of Holland Colombo Trading Society, Inc., 80-82 Wall St., New York 5, N. Y., importer of and dealer in crude rubber and sole crepes.

Sidney T. Pruitt, Jr., Chicago regional manager for Ethyl Corp. of America, on January 9 was appointed director of the Rubber, Chemicals, Drugs & Fuels Division, OPS. He succeeds **E. Edgar Fogle**, director of the division since June, 1952, who returns to the Carbide & Carbon Chemical Co., New York, N.Y., where he is assistant sales manager.

Edwin Earl Calvin, son of Edwin Calvin, late chairman of the board of The Bearfoot Sole Co., Inc., Wadsworth, O., has been named a director to fill the unexpired term of his father, who died January 6. The younger Mr. Calvin started his business career in New York with Pacific Mills, but came to Bearfoot in 1938. In September, 1950, he was elected a vice president of the company, in charge of personnel.

A. T. Fiore has been appointed coordinator of new product development and service laboratories of Givaudan-Delawanna, Inc., and its affiliate, Sindar Corp., 330 W. 42nd St., New York 36, N. Y. Mr. Fiore joined Givaudan twenty years ago as chemist in charge of the analytical department and since 1934 has been a research associate of The Givaudan Corp.

Bradley Dewey (*Right*) Receives Employes' Testimonial from W. L. Taggart

Bradley Dewey, co-founder and former president of Dewey & Almy Chemical Co., Cambridge 40, Mass., was presented with an illuminated testimonial from the employes of the firm's various plants at a ceremony in Cambridge on January 6. Mr. Dewey retired as company president on December 31 to become chairman of the board. The presentation was made by W. L. Taggart, vice president—manufacturing, on behalf of the employes, and consisted of a gold embossed leather volume engrossed with the names of the firm's employes in 13 plants in the United States, Canada, Europe, South America, and Australia.

Clinton B. McKeown has been named superintendent of the aeronautical manufacturing division of The B. F. Goodrich Co. McKeown, with the company 15 years, worked for a time in its chemical laboratories and later held technical posts in the processing and tire divisions. In 1942 he joined the technical staff of B. F. Goodrich Chemical Co., where he handled varied technical assignments. In 1950 he became manager of raw materials inspection and development and was made technical superintendent of the aeronautical division in January, 1952.

Earl F. Daugherty, since June 16, 1951, technical serviceman at Plant 2, Goodyear Tire & Rubber Co., Akron O., has been transferred to the firm's plant at San Jose, Cuba, as assistant to the vice president in charge of production. Daugherty first joined Goodyear in September, 1950, as draftsman. He previously had been employed by the Vaughn Machinery Co. as an apprentice engineer—maintenance and testing.

Richard B. Robinson, since 1945 chief pilot for The Firestone Tire & Rubber Co., Akron, O., is now a special representative for the company's defense products division. Mr. Robinson joined the Firestone sales training class in 1939 and was employed in Boston district sales until 1940, when he became an instructor for Air Force cadets. From 1943 to 1945 he was with the Pan-American Air Ferries Co. and Pan-American World Airways, but in 1945 returned to Firestone. He is the son of the late B. M. Robinson, for many years secretary, chief counsel, and a director of the Firestone company.

Roy Faigenbaum has been appointed vice president in charge of sales for Fidelity Machine Co., Inc., Philadelphia, Pa., to succeed Howard Green resigned. An engineer with Fidelity for many years, Mr. Faigenbaum has been closely associated with the development of precision machinery for the textile, rubber, and wire industries.

H. M. Thomas has been appointed manager of the Akron district (eastern Ohio and western Pennsylvania) of The Firestone Tire & Rubber Co., Akron, O. Mr. Thomas joined the Firestone organization as a member of the 1932 college sales training class, and has held various positions in the sales division. For the past six years he has been store supervisor in the Akron district.

John Collyer, president of The B. F. Goodrich Co., was named last month to the executive committee of the Business Advisory Council to the United States Department of Commerce. Mr. Collyer, a member of the Council, was elevated to its executive committee by then-Secretary of Commerce Charles Sawyer in the last week of the Democratic administration. The Council advises the Secretary on business problems and policy and makes special studies at his request.

Frank Zvanut, formerly ceramic engineer for Ferro Corp., has been signed as sales engineer by Godfrey L. Cabot, Inc., Boston, Mass., for its recently acquired subsidiary, Georgia Pigment Co., Sandersville, Ga., producer of kaolin clays. Zvanut will be responsible for the sale of Georgia kaolins to the ceramic and fiber glass industries and will serve in a consulting capacity to the Cabot ceramic research laboratory in Boston and to the new control laboratory at the Sandersville plant.

John Ottens has been appointed as sales representative from the Chicago office, for Baker Castor Oil Co., 120 Broadway, New York 5, N. Y. Mr. Ottens started as a research chemist with Universal Oil Products and later joined Witco Chemical Co. as a technical representative. He subsequently worked for Carl A. Lechner Co.

D. Morris Pratt has been elected a vice president of Marbon Corp., Gary, Ind., a subsidiary of Borg-Warner Corp. Mr. Pratt joined Marbon in 1934 as a laboratory technician and in 1946 became sales manager, a title which he will also continue to hold. He previously had been in the employ of Goodyear Tire & Rubber Co. and Herron & Meyer.

Fred V. Maloon has been appointed director of general sales, Boston Woven Hose & Rubber Co., Cambridge, Mass. Mr. Maloon's entire business career has been in the rubber industry. For six years, ending in 1951, Mr. Maloon handled factory sales and specifications for the 75-year-old manufacturer of mechanical rubber goods and plastics. Since August, 1951, he has been manager of its New York office. Now he is charged with full responsibilities for the activities of the general sales organization of Boston Woven Hose & Rubber Co.

OBITUARY

Edwin Calvin, Sr.

EDWIN CALVIN, SR., chairman of the board of directors of The Bearfoot Sole Co., Wadsworth, O., died at a Cleveland hospital, January 6, after a long illness.

The deceased was born in Nashville, Ind., May 12, 1890. He received his high school education in Cambridge, Mass., studied piano at the New England Conservatory of Music, and attended Harvard College.

He was connected for many years with the leather industry in Boston, and was working with England-Walton Leather Co. in February, 1924, when he and his brothers, Ernest and I. B., founded Bearfoot Sole. As the company's president and sales manager, Edwin Calvin pioneered rubber and fiber soles for shoes and developed many designs and styles for rubber soled footwear.

In 1945, after having been seriously injured in an automobile accident, he relinquished his duties as sales manager, and in 1952 I. B. Calvin became the company's president.

Private funeral services were held January 9 at Holy Cross Cemetery in Bath, O., followed by memorial services the same day in the Bath Community Church, where Mr. Calvin had been an active member.

Besides the widow, survivors include a son, Edwin Earl, who is vice president and personnel manager of Bearfoot Sole, three brothers, two sisters, and a grandson.

George R. Weber

GEORGE R. WEBER, vice president, treasurer, and a director of Raybestos-Manhattan, Inc., and general manager of its U. S. Asbestos-Grey-Rock Division, Manheim, Pa., died January 14 at his home in Lancaster, Pa.

Mr. Weber became affiliated with the U. S. Asbestos plant in 1921 and took an important part in creating the Raybestos-Manhattan merger in 1929.

He was also an officer of Appel & Weber, Lancaster jewelers; a member of the board of directors of St. Joseph's Hospital and the Fulton National Bank, both of Lancaster, and of the Hamilton and Lancaster Country, and Everglades clubs.

Lz A. Brown

LZ ADAM BROWN, president and founder of the Corduroy Rubber Co., Grand Rapids, Mich., suffered a fatal heart attack, December 8, at his winter home in Monrovia, Calif.

Mr. Brown was born in Nashville, Mich., 70 years ago, and attended public school there.

He began his business career as a salesman for the Alabastine Co. A short while later he became associated with the rubber industry by taking a job with Continental-Caoutchouc, Chelsea, Mass.; then he joined United States Rubber Co. as a district manager. In 1916 he became vice president of the Mid-Continental Tire & Rubber Co., Wichita, Kan. Next he opened his own tire distributing firm under the name Adam Brown Co. and in 1919 organized the Grand Rapids Tire & Rubber Co., which became the Corduroy Tire Co. in 1926, and Corduroy Rubber Co. in 1931.

The deceased belonged to the Peninsular Club, Elks, Grand Rapids Chamber of Commerce, and National Association of Manufacturers.

On December 10 memorial services were held at Monrovia, Calif.; then the body was removed to Grand Rapids, where additional services took place December 13, before burial in the family plot at Whitneyville, Mich.

The widow is the sole survivor.

CANADA

Cabot Adds Personnel

Godfrey L. Cabot, Inc., 77 Franklin St., Boston 10, Mass., announced that the personnel of Delacour-Gorrie, Ltd., joined Cabot Carbon of Canada, Ltd., on January 1. The Canadian company will be producing oil furnace blacks early in 1953 at Sarnia, Ont., and will also act as sales representative for all carbon blacks, pine products, plasticizers, and other materials manufactured by Godfrey L. Cabot.

New Polyethylene Plant

Canadian Industries, Ltd., Montreal, P.Q., is building Canada's first polyethylene plant near Edmonton, Albta. The $13,000,000 plant, scheduled for completion late this year, will produce about eight times the polyethylene now available in Canada through imports from the United States and Britain. The Edmonton area was selected as the site for the plant because of its oil fields and natural gas which is used as the raw material for the manufacture of polyethylene.

Rubber Stocks, Use Up

Canada's combined stocks of rubber—natural, synthetic, and reclaim—on October 31, 1952, rose to 12,631 tons from 12,458 a year earlier, the Dominion Bureau of Statistics reported. Consumption in October increased to 7,415 tons from 6,897; while domestic production of synthetic and reclaim advanced to 6,781 tons from 6,405.

Month-end stocks of natural rubber declined to 3,903 tons from 5,518; reclaim to 1,379 tons from 2,353; but synthetic rose to 7,349 tons from 4,587. Consumption of synthetic increased to 2,908 tons from 2,369; while natural rubber and reclaim were practically unchanged at 3,247 and 1,260 tons, respectively.

Domestic production of synthetic and reclaim rubber during the year increased, the former at 6,362 tons from 6,036, and the latter at 419 tons from 369.

Combined stocks on November 30, 1952, totalled 10,797 long tons, compared with 10,353; while consumption increased to 7,756 tons, against 6,413, a year earlier. Domestic production of synthetic and reclaim was practically unchanged.

Month-end stocks of natural rubber declined to 3,036 tons from 3,688, and reclaim to 1,463 tons from 2,261; while inventories of synthetic rubber rose to 6,298 from 4,404 tons.

Consumption of natural rubber increased to 3,382 tons from 2,948, synthetic to 3,155 tons from 2,388, and reclaim to 1,219 tons from 1,077.

Output of synthetic rubber dropped to 5,804 tons from 5,874 a year earlier, but that of reclaim rose to 419 tons from 339.

FINANCIAL

Boston Woven Hose & Rubber Co., Cambridge, Mass. Quarter ended November 30, 1952: net income, $45,123, equal to 7¢ each on 344,000 common shares, contrasted with $230,489, or 61¢ a share, in the 1951 quarter; sales $3,966,237, against $5,412,728.

Collins & Aikman Corp., New York, N. Y. Nine months to November 29, 1952: consolidated net income, $540,000, equal to 96¢ a common share, contrasted with $2,707,000, or $4.81 a share, a year earlier; sales, $33,932,269, against $47,750,000.

Dayton Rubber Co., Dayton, O. Year ended October 31, 1952: net profit, $1,500,875, equal to $2.47 each on 571,504 common shares, contrasted with $2,192,413, or $3.67 a share, in the previous 12 months; net sales, $54,023,245, against $54,602,954; income and excess profits taxes, $543,000, against $3,929,221; current assets, $18,560,697, current liabilities, $6,960,288, against $17,091,008 and $8,323,953, respectively, on October 31, 1951.

Diamond Alkali Co., Cleveland, O. For 1952: net income, $5,461,820, equal to $2.18 each on 2,262,303 common shares, compared with $6,674,297, or $2.95 a share, in 1951; net sales, $76,673,311, against $80,748,796.

Dow Chemical Co., Midland, Mich. Six months to November 30, 1952: net income, $17,224,023, equal to 77¢ each on 21,433,016 common shares, compared with $17,284,891, or 84¢ each on 6,606,139 shares, a year earlier; sales, $204,944,652, against $200,325,476.

Endicott Johnson Corp., Endicott, N. Y. Year ended November 30, 1952: net earnings, $2,572,161, equal to $2.82 a common share, against $2,329,302, or $2.52 a share, in the preceding fiscal year.

Firestone Tire & Rubber Co., Akron, O. Year ended October 31, 1952: net income, $43,081,717, equal to $10.89 a common share, contrasted with $48,398,950, or $12.26 a share, in the preceding fiscal year; net sales $965,364,427, against $975,766,455.

Glidden Co., Cleveland, O. Year ended October 31, 1952: consolidated net income, $6,948,805, equal to $3.01 a common share, contrasted with $8,313,868, or $3.65 a share, in the preceding fiscal year; net sales, $205,113,304, against $228,522,503.

Johns-Manville Corp., New York, N. Y. For 1952: net profit, $22,619,951, equal to $7.14 a common share, against $24,530,509, or $7.76 a share, in 1951.

Lee Rubber & Tire Corp., Conshohocken, Pa., and subsidiary. Year ended October 31, 1952: net income, $1,767,179, equal to $6.66 each on 265,199 capital shares, contrasted with $2,185,632, or $8.62 each on 253,584 shares, in the preceding fiscal year; net sales, $45,335,579, against $50,402,406; income taxes, $1,339,200, against $2,711,554; current assets $19,484,358, current liabilities, $3,229,754, against $20,993,241, and $4,122,027, respectively, on October 31, 1951.

Midwest Rubber Reclaiming Co., East St. Louis, Ill. Year ended October 31, 1952: net profit, $568,613, equal to $1.83 a common share, compared with $650,453, or $1.98 a share, in the preceding fiscal year; sales, $7,296,378, against $9,620,597; income taxes, $810,000, against $1,395,000; current assets, $2,649,928, current liabilities, $1,227,583, against $4,031,873 and $2,171,972, respectively, on October 31 1951.

Phillips Petroleum Co., Bartlesville, Okla. For 1952: net income, $75,300,000, equal to $5.17 a share, compared with $73,700,000, or $5.11 a share, the year before.

Rome Cable Corp., Rome, N. Y. Nine months to December 31, 1952: net earnings, $1,550,000, equal to $3.17 a common share, compared with $1,101,000, or $2.24 a share, a year earlier.

Shell Oil Co., New York, N. Y. For 1952: net profit, $90,800,000, equal to $6.75 a share, against $97,020,000 or $7.20 a share in 1951.

Sun Oil Co., Philadelphia, Pa. For 1952: consolidated net profit, $43,013,063, equal to $6.01 a share, compared with $45,353,643, or $6.85 a share, in the preceding year.

SPE Sections

(*Continued from page 657*)

follows: membership, R. M. Thews, Monsanto Chemical Co., (to July 1), and Murray Beck, Leaf Plastics, Inc., (after July 1); program, I. I. Rubin, Robinson Plastics Corp. (to July 1), and H. J. Weber, Rotuba Extruders, Inc. (after July 1); house, Guy Martinelli, Sylvan Plastics, Inc.; credentials, George Baron, Ideal Plastics Corp.; prizes and favors, C. W. Virgin, Naugatuck Chemical; employment, A. L. GeWertz, Kreiger Color & Chemical Co.; mailing, G. P. Humphrey, R. C. Molding Co.; education, H. H. Schwartz, Empire Brushes, Inc.; and publicity, A. M. Merrill, India RUBBER WORLD.

Chicago Section Officers

The joint meeting of the Chicago Section, SPE, and the Midwest Chapter, SPI, held at the North Park Hotel, in Chicago, Ill., January 14, heard Warden John Ragen, Stateville Prison, Joliet, Ill., talk on the problems and responsibilities of the warden of a large state prison.

Officers of the Chicago Section, SPE, for 1953 were announced as follows: president, John T. Bent, Tennessee Eastman Corp.; vice president, Ned H. Porte, General American Transportation Corp.; and secretary-treasurer, R. P. Smith, Bakelite Division, Union Carbide & Chemicals Corp. Directors are Maurice Meltzer, Service Plastics Co.; Le Roy J. Smith, Jarrow Products Co.; T. H. Cleavenger, Anesite Co.; H. C. Carlson, Koppers Co.; T. F. Muchenfuss, J. B. Products Co.; F. L. Fine, Rohm & Haas Co.; and M. A. Self, Bee Chemical Co.

It was announced by Sam Melvin, of Monsanto Chemical Co., that Erik Nielsen, Armour Research Foundation, was a winner in the prize paper contest of the Society of Plastic Engineers.

Davis on Preplasticizers

A talk on "Preplasticizers" by R. E. Davis, Hydraulic Press Mfg. Co., highlighted the December 19 dinner-meeting of the Buffalo Section, SPE, held at the Elks Club, Buffalo, N. Y. The speaker discussed the development of preplasticizing types of injection molding machines, noting that HPM had employed the principle of preplasticizing as early as 20 years ago.

Mr. Davis defined preplasticizing as the condition wherein granulated or powdered molding material is completely plasticized before coming into contact with the injection plunger which forces the material into the mold. Advantages of preplasticizing were presented as follows: (1) increase in plasticizing capacity for a given-size machine; (2) increase in shot capacity of the machine; (3) production of relatively strain-free parts; (4) reduction of weight per part; (5) reduction of temperature in heating chamber; (6) more effective utilization of mold clamping force; (7) reduced distortion; (8) improved mold release; (9) improved color dispersion; and (10) improved surface finish and color of the part.

Plastic Pipe Flow Data

PERMUTIT CO., New York, N. Y., has issued a table of hydraulic conversion factors for obtaining the friction, velocity, and friction head of fluids in plastic, plastic lined, and light wall steel pipes. Prepared by Stanley Lenox, of Permutit, the table is designed or use by engineers, designers, and others who must deal with the flow of liquids in other than standard steel pipes. Based on pipe materials and sizes currently in use, the table covers pipe made of thin steel; rubber and saran lined steel; Uscolite, saran, and Parian plastics; and hard rubber.

Extruded Pipe Research Program Continues

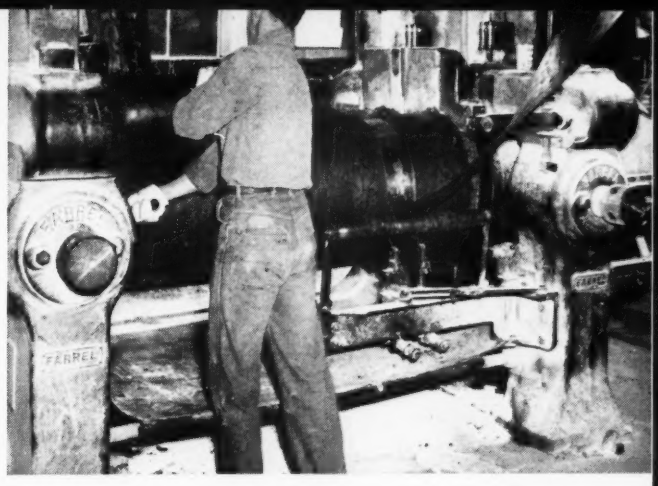
THE National Sanitation Foundation, University of Michigan School of Public Health, Ann Arbor, Mich., has announced that the research evaluation study on extruded thermoplastic pipe has entered its second year of operation. According to Walter D. Tiedeman, director of the Foundation's testing laboratory, the project is sponsored by The Society of the Plastics Industry, Inc., and is intended to evaluate the non-toxicity of plastic pipe in the underground transmission of water. Plastic raw materials now undergoing tests include polyethylene, polystyrene, cellulose acetate butyrate, and vinyl chloride copolymers.

A joint committee of public health officials, plastic pipe extruders, and material suppliers meets periodically with Foundation officials to coordinate activities of the research program. Work to date has involved a study of the possible action of various types of "aggressive" natural waters in extracting substances from plastic pipe. Long-range critical studies are about to begin in which various types of waters will be exposed for long periods of time to different plastics in self-contained circulating systems of plastic pipe. At the conclusion of the project, which will take at least another year, a comprehensive report will be prepared and disseminated to public health officials, industry representatives, and educational establishments throughout the country.

Dividends Declared

COMPANY	STOCK	RATE	PAYABLE	STOCK OF RECORD
Armstrong Rubber Co.	Cl. A & B	$0.50 q.	Apr. 1	Mar. 17
	4¾% Pfd.	0.59⅜ q.	Apr. 1	Mar. 17
Bearfoot Sole Co.	Com.	0.15	Feb. 2	Jan. 20
Boston Woven Hose & Rubber Co.	Com.	0.20	Feb. 25	Feb. 16
Collyer Insulated Wire Co.	Com.	0.50	Feb. 1	Jan. 23
Crown Cork & Seal Co., Inc.	Pfd.	0.50 q.	Mar. 14	Feb. 17
Firestone Tire & Rubber Co.	4½% Pfd.	1.12½ q.	Mar. 1	Feb. 13
Goodyear Tire & Rubber Co.	Com.	0.75 q.	Mar. 16	Feb. 16
	$5.00 Pfd.	1.25 q.	Mar. 16	Feb. 16
Minnesota Mining & Mfg. Co.	Com.	0.25	Mar. 12	Feb. 14
	$4.00 Pfd.	1.00 q.	Mar. 12	Feb. 14
Okonite Co.	Com.	0.50	Feb. 2	Jan. 19
Philadelphia Insulated Wire Co.	Com.	0.60 semi-an.	Feb. 16	Feb. 2
Union Asbestos & Rubber Co.	Com.	0.25 q.	Apr. 1	Mar. 10

IDEAL FOR ALL STOCKS. Besides costing less than any of the five process aids it replaced, and its other advantages, Sundex-53 mixes easily with natural, GR-S and reclaim stocks. In the picture above it is shown being added to a batch of heel stock.



QUICKER, MORE THOROUGH PLASTICIZATION. By using Sundex-53 only, the company has been able to produce a more uniform finished product. Quality heels will be blanked out of the stock leaving this warm-up mill and entering the cutter.

SINGLE GRADE OF SUNDEX REPLACES 5 PROCESS AIDS

Some years ago, as an economy step, the Beebe Rubber Company, Nashua, N.H., tried to reduce the number of process aids it used. Five different types were being employed in the processing of natural, GR-S and reclaim stock for heels, soles and soling slabs.

A Sun representative who had been called in recommended replacing all five process aids with Sundex-53 and the company took his advice. This one "general purpose" rubber-process aid has more than just simplified inventories and purchasing; *it has proved advantageous in other respects besides.* Because of the way it is refined, it works as well with light colored stock as with dark. It quickly breaks down reclaims and does not overprocess natural rubber and GR-S polymers. It costs less than the process aids it replaced, and has eliminated the potential danger of mixing errors.

For more information about Sundex-53 and other Sun Rubber-Process Aids, write to us for the booklet "Processing Natural Rubber and Synthetic Polymers," offered in coupon below.

ECONOMIES ALL ALONG THE LINE. Sundex-53 not only costs less than any of the five products it replaced, but it also saves money through simplification of ordering and stocking. The operator shown above is setting up a mold to vulcanize heels.

SUN OIL CO., Dept. RW-2, Philadelphia 3, Pa.

I am having trouble that may be due to inadequate process aids. I should like to have: ☐ the services of a Sun representative; ☐ the booklet "Processing Natural Rubber and Synthetic Polymers."

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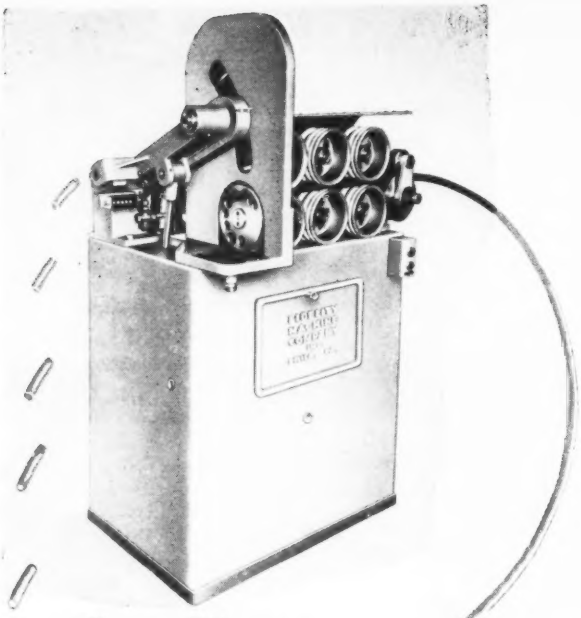

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Measuring and Cutting Machines

Revolutionary in design, the Fidelity Automatic Hose Measuring and Cutting Machine enables you to reduce labor costs, improve quality, boost output, prevent waste, and save floor space.

The Fidelity feeds, measures, counts and *cuts* hose automatically to any preset length and holds the closest tolerances. It takes only a moment to change length or diameter. One operator can handle several of these new Cutting Machines. No special skills are required and the operation is 100% *safe.*

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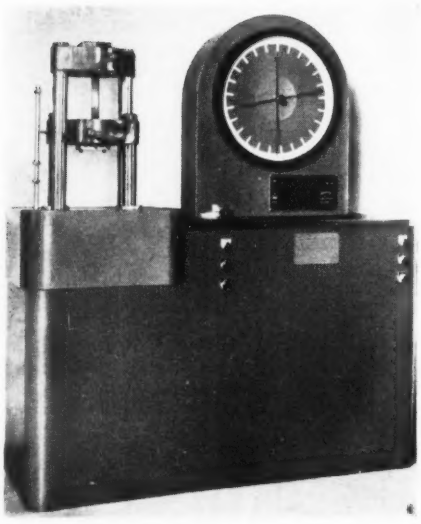


New Model 60-H Baldwin Universal Testing Machine

New Universal Testers

NEW models of its Baldwin 60-H and 12-H testing machines, with capacities of 60,000 and 12,000 pounds, respectively, have been announced by Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa. While retaining many of the features of the company's larger machines, the new models show three important changes: (1) increase in clear space between columns from 10 to 15 inches; (2) single-unit construction, with a separate framework for the gage panel to prevent the shock of breaking specimens from being transmitted to the load indicator; and (3) choice of two types of indicators. The first type of indicator has two Emery 16-inch diameter dials; while the other type uses the Tate Emery indicator with three ranges on a single 24-inch dial.

Both new models feature rigid loading systems consisting primarily of two cages. Tension or compression load is applied upward by a movable cage made up of the machine table and two columns supporting the upper gripping head. This cage is attached to the piston in a hydraulic cylinder in the base of the machine and has a six-inch stroke. Loading speed can be varied between 0-2 inches a minute on the 60-H machine, and

SEE PAGE 580

Only one tapered roller bearing gives you all these 10 advantages...

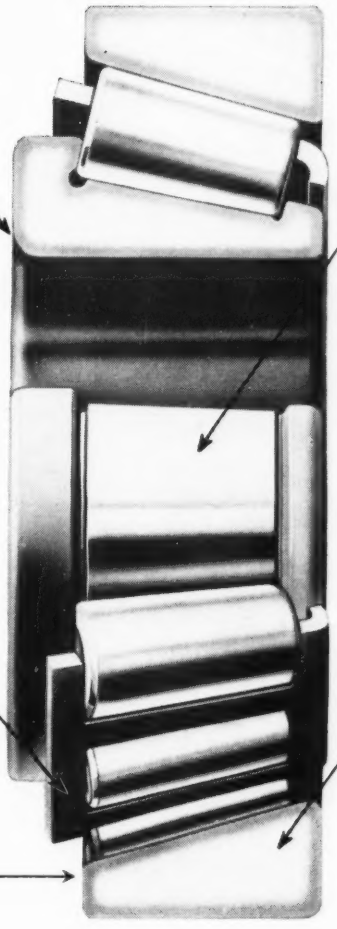
1 **GENEROUS RADIUS**—for greater shaft strength.

2 **CHOICE OF 26 DIFFERENT TYPES.**

3 **SOFT STEEL CAGE**—to keep rollers separate and prevent scuffing.

4 **PRECISION MANUFACTURE**—which makes possible bearings with a maximum runout tolerance of less than 75 millionths of an inch.

5 **CASE-HARDENED BEARING SURFACES**—to resist wear.



6 **MICRO-INCH SURFACE FINISH**—to minimize friction.

7 **CHOICE OF 5850 SIZES.**

8 **TIMKEN FINE ALLOY STEEL**—specially developed to give long bearing life.

9 **TOUGH CORE**—to resist shock.

10 **POSITIVE ROLLER ALIGNMENT**—gives maximum bearing capacity.

...it's stamped with the trade-mark "TIMKEN®"

NO other bearing gives you *all* the advantages you get with Timken® bearings. Ten of these advantages are listed above. They result from the fact that the Timken Company is the foremost producer of tapered roller bearings and leads in 1) advanced design, 2) precision manufacture, 3) rigid quality control, and 4) special analysis steels.

Be sure that every bearing you use in the machines you build or buy is stamped with the trade-mark "Timken". The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

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may be what you need.
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SUPPORTS ONE END OF AN IDLER ROLL—

MEASURES
TENSIONS
in lbs. pull on remote dial.

Can be installed on any present idler roll and may be mounted in any plane. It's self-contained, small size, easily installed.

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FOR CONSTANT TENSION

This "LOD-CAP" Automatic Control can be added for single or multiple units without changes to remote reading indicating circuit.

Operates on 60 lb. Minimum Air Pressure
No Electric Circuits or Wiring

LOW COST—WIDE LOAD RANGE

Simplicity of construction keeps cost down. Load ranges from 0-1 lbs. to 0-12,000 lbs. make LOD-CAPS adaptable to many varied industries.

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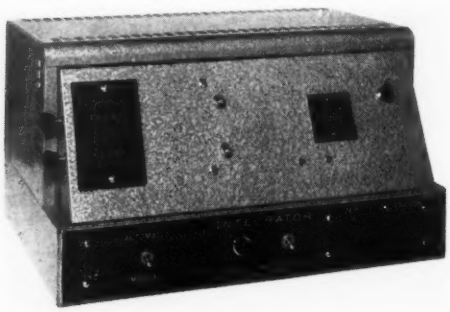
between 0-4 inches a minute on the 12-H machine. The lower gripping head is the upper member of the second cage which also includes two long columns extending down through the table to a lower cross-head. This lower gripping head has a 17-inch adjustment range by means of a motor drive; adjustment provides a vertical space of 1-18 inches for test purposes.

In addition to the standard 0-12,000- and 0-3,000-pound ranges on the 60-H and 12-H units, respectively, several other ranges are available. Other ranges provided with the Tate Emery indicator are 0-2,400 and 0-1,200 pounds on the 12-H, and 0-12,000 and 0-24,000 pounds on the 60-H. Stress-strain recorders and other accessories are also available. Both machines are 67½ inches wide, 27 inches in overall depth, and 77½ inches in height over the indicator.



Instron Two-Counter Model Integrator

Integrating Instrument

AN AUTOMATIC electro-mechanical Integrator operating on standard computor techniques to provide an accurate time-integral of any D.C. input function has been announced by Instron Engineering Corp., Quincy, Mass. Applications of the unit include integration of stress-strain curves, analysis of graphical data, continuous process weighing, total water content determinations, totalizing illumination in weathering or fading tests, and integration of two independent variable signals with respect to each other.

The instrument combines the advantages of mechanical and electronic integrators to provide high-speed response, long time stability, and unlimited output. A measure of the time integral of the input is registered on a mechanical revolution counter geared to the output. The output speed is made directly proportional to the integrated input signal through an accurately controlled variable speed drive with tachometer feed-back. In addition, a high-speed electronic integrator instantaneously integrates any transients or tachometer response errors and applies a correction factor. When used with a potentiometer recorder or other mechanical input, the signal is derived from a multi-turn potentiometer which can be supplied from a stabilized voltage source incorporated in the unit.

The Integrator is available in models having one or two counters. The two-counter model, shown in the accompanying illustration, incorporates electric clutches and can be operated either manually or automatically from some auxiliary switching function. This is useful in determinations where it is desirable to integrate separately the successive portions of a curve, such as the trace and retrace portions of a hysteresis cycle.

Publications of Monsanto Chemical Co., Springfield, Mass. **"Injection Molding Lustrex Styrene Plastic."** Production Information Bulletin No. 81. 30 pages. Designed primarily for the injection molder, this booklet provides valuable detailed information on basic considerations of molding equipment, mold construction, material selection, molding problems, and the evaluation of production efficiency.

"Lustrex X-820." Development Bulletin, October, 1952. 6 pages. Tentative Data Sheet, revised October, 1952. 2 pages. The bulletin presents information on the processing, compounding and applications of the resin which is suitable for use as a film former, thickener, emulsifier, dispersing agent, binder, and modifier of solutions. Detailed data on the properties of Lustrex X-820 are provided in the data sheet.

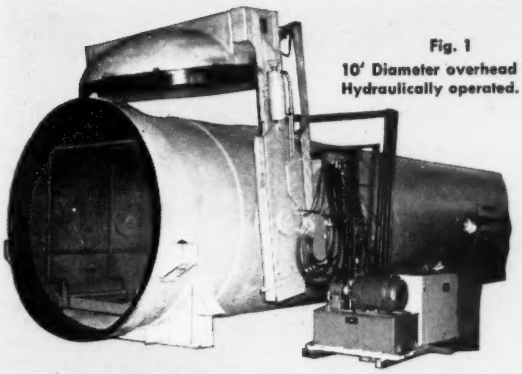


Fig. 1
10′ Diameter overhead door.
Hydraulically operated.

Fig. 2
5′ Diameter hinged door
for vertical vessel.

Quick Opening Doors

by STRUTHERS WELLS

TYPES FOR ALL REQUIREMENTS
UP TO 600 PSI WORKING PRESSURE—
TO 700°F. MAXIMUM TEMPERATURE

Expanding Locking Ring Door

Struthers Wells expanding locking ring type doors as illustrated in Figures 1, 2 and 3 are made for vertical and horizontal use—in hinged and overhead types. A synthetic rubber gasket is self-sealing and is recommended for use to 400°F steam and pressures to 600 psi, depending on the size of vessel. Made in 3′ to 12′ diameters.

Lug Type Door

Struthers Wells lug type door (See Fig. 4) features a rectangular asbestos gasket in a groove—for severe operating conditions of temperature and hard to hold chemicals. Quickly and easily operated for rugged service conditions, this type door is furnished with anti-friction hinge bearings, and hydraulic unit for locking and unlocking door.

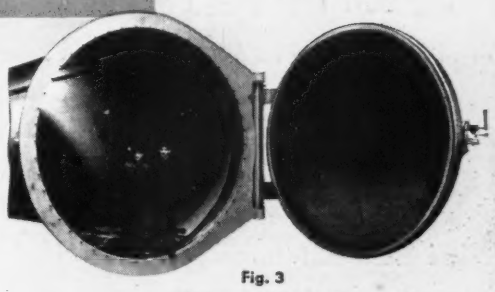


Fig. 3
12′ Diameter hinged door
for horizontal vessel.

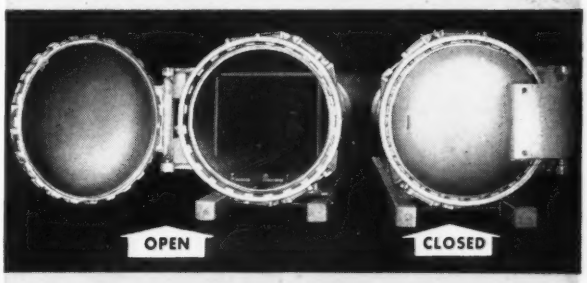


Fig. 4
Ideal for wood preserving operations, hard to hold chemicals and high temperature service.

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Consult Struthers Wells for Quick Opening Doors best suited to your specific requirements.

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NEW PATAPAR
Releasing Parchments

Four new releasing types of Patapar Vegetable Parchment have characteristics which make them ideal as protective backing or wrapping materials for tacky substances. Their dense, fibre-free surfaces release easily from a wide variety of uncured natural or synthetic rubbers. They are used as separator sheets for uncured rubber, rubber tape, and as backing for pressure sensitive surfaces.

Important qualities

Although each of the four new releasing types of Patapar differ in properties and appearance, each type offers these advantages:

- **Low cost**
- **Excellent release from many tacky surfaces**
- **Dense, fibre-free surfaces**
- **Releasing qualities remain constant as time passes**
- **High resistance against penetration or migration by rubber softners and oils**

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New Materials

New Thermal Black — Sterling MT

STERLING MT, a new medium thermal carbon black, has been announced by Godfrey L. Cabot, Inc., Boston, Mass. Sterling MT is available in commercial quantities; tests indicate suitability in applications such as mechanical and extruded rubber goods.

Analytically this new medium thermal black has a surface area of six square meters per gram, volatile content less than 0.1%, oil absorption of 0.37 cc. per gram, extract of 0.05, low moisture, low DPG absorption, and a specific gravity of 1.8. Sterling MT has a nigrometer (color) scale index of 115, which makes it considerably grayer than SRF black.

Tests in various rubber compounds show the equivalence of Sterling MT to a competitive medium thermal black. Competitive test data on modulus, tensile strength, elongation, hardness, resilience, compression set, heat build-up, extrusion shrinkage and stock viscosity, at loadings of 75, 100, and 125 parts on 100 rubber, show that Sterling MT can be used to advantage in all medium thermal black applications, wherever low cost, good resilience, and high loading capacity combination is important, according to Cabot technical staff.

SE-550—New Silicone Rubber

A NEW silicone rubber, SE-550, that remains flexible at —120° F. and can be produced with uniform high quality has been announced by General Electric Co., Waterford, N. Y. The result of two years of development and field testing, the new medium-durometer rubber is expected to find wide application in gaskets and seals on fuselage equipment of high-altitude aircraft, as well as in wire insulation for ignition systems of arctic ground equipment.

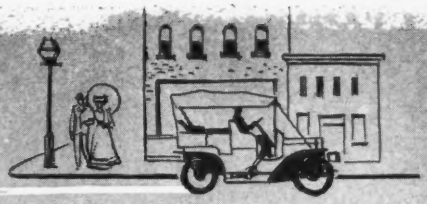
The new material is believed to have the lowest change in bending modulus of any commercially available elastomer. It is said to show less than 25 points durometer increase over the temperature range from 500 down to —120° F; while its brittle point is well below —120° F. The rubber is claimed to outperform all other silicone elastomers at any low temperature, while still retaining the heat resistance of up to 500° F. of most other silicones.

According to G-E, the new rubber is easily worked by fabricators. It can be removed from the container with no difficulty, mills and extrudes easily, and its good tear strength permits stripping from hot molds. SE-550 can also be used as a base stock to produce compounds of different hardnesses and compression sets and can be colored with a wide range of heat-stable pigments. The rubber is currently available in compound form, and the firm plans to market it in gum form later this year.

Latex Dewebbing Compound

A NEW dewebbing compound for use in latex dipping has been developed by Federal Latex Corp., Brooklyn, N. Y. Federal Dewebbing Compound prevents the formation of "webs" of dipping compound between adjacent part of the dipping mold. The material is also said to permit more faithful reproduction of the mold by the dipped part, to reduce finishing requirements for the parts, and decrease the number of rejected parts. The new product is a white liquid having a 40% solids content, pH of 8-8.5, and a viscosity of 25-60 centipoises. The material shows a slight separation upon long-term storage, but can easily be redispersed by agitation. Recommended quantities for usage are 1-2% of dewebbing compound in the latex dip formulation.

"Synthetic Methanol." Commercial Solvents Corp., New York, N. Y. 32 pages. Comprehensive information is presented in this bulletin on the specifications, properties, and uses of methanol, as well as its toxicology, shipping, handling, storage, and specification test methods.



REMEMBER THIS TREAD?

it is the original Firestone "Non-Skid" tread, first introduced in 1908

Many of you in the tire industry today will remember this famous tire of yesterday . . . and how it changed the concepts of tire tread designs, helping to bring a greater measure of safety on the road. It was one of the many milestones which marked the swift progress of the young tire industry.

Down through the years — since 1906 in fact — The Bridgwater Machine Company has consistently worked with the tire industry, helping it meet continually expanding demands for automotive tires by furnishing molds and equipment of highest quality.

Our Athens Machine Division, in Athens, Ohio, is, we believe, the only plant in the world devoted exclusively to tire mold making. Here, skilled workmen and specialized machines — many of our own design — produce molds of every size and type, in engraved steel, cast iron, or aluminum.

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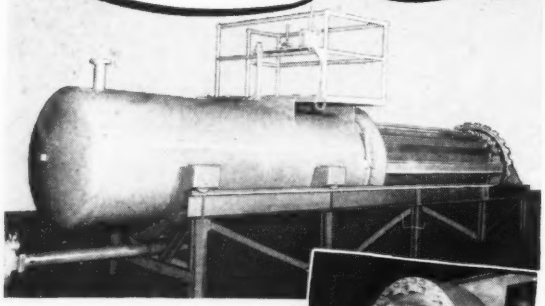

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New Goods

Goodyear's Grip Tred Snow Tire for Trucks

Snow Tire for Trucks

A NEW Tire, the Grip Tred, has been developed by Goodyear Tire & Rubber Co., Akron 16, O., to provide superior traction to light trucks on snow, ice, and other slippery surfaces. The tire tread is composed of hundreds of sharp edged cleats which bite into loose or hard packed snow to provide extra grip. The cleats are flexible for self-cleaning and are pitched so as to give traction regardless of direction of motion. Spacing the cleats more closely than on previous tires of this type is said to provide a smoother, quieter ride.

Other features of the tire include a wider, flatter tread to help prevent irregular wear; triple grooved tread to resist side slipping; and indented shoulder design on the tread for extra grip. The Grip Tred is a companion tire to the firm's auto snow tire, the Suburbanite, previously announced. The new tire is made in 15-, 16-, and 17-inch diameter sizes and is especially suitable for delivery-type and light trucks used on farms.

Rayon Fabric Belt

Original Installation of Goodrich's Drivesall Rayon Fabric Belt on Stone Crusher Was Made More Than a Year Ago

A NEW rubber transmission belt made with all-rayon fabric has been announced by The B. F. Goodrich Co., Akron, O. Called the Drivesall, the rayon fabric belt is claimed to be 25% stronger, have up to 10 times greater flex life, and show 50% less stretch than cotton fabric belts made with the same number of plies. The improved properties of the belt are said to result from the use of rayon filaments formed in continuous lengths, as contrasted with the short-length fibers of cotton duck.

Since the rayon fabric plies are 30% thinner than cotton plies, they flex easier over small-diameter pulleys, and more plies can be used to make stronger belts. A six-ply Drivesall belt is only as thick as a four-ply, 32-ounce cotton fabric belt. The new belt is designed for use on medium-duty drives for fans, blowers, compressors, pumps, machine tools, crushers, mills, and many special types of machinery used in the rubber, plastics, paper, oil, and printing industries.

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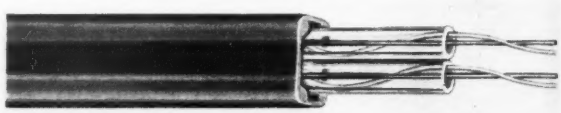
New U. S. Royal Truck Tire

THE U. S. Royal Fleetway, a new truck tire said to embody radical improvements in design, has been announced by United States Rubber Co., Rockefeller Center, New York 20, N. Y. The tire is claimed to reduce road failures and give up to 41% more original tread miles than previously realized with tires sold at regular prices. The new tire is made under four patented processes to reduce groove cracking, as follows: infrared radiation is used to toughen the grooves; the Micro-Mix tread is compounded by a new hot process that homogenizes all elements of the tread; the rayon cords are solutioned in a special plastic resin to insure permanent bonding of the rubber coating and insulate the cords against chafing; and a newly developed chemical is used in the sidewall compound to inhibit weather checking.

New U. S. Royal Fleetway Truck Tire

Other features of the new truck tire include a wider center rib with narrow outer ribs; heat resistant ventilated shoulders; a five-row rib design in sizes through 10-inch cross-section, and a seven-row rib design in larger sizes; double shock pads impregnated with tread rubber and bonded permanently to the carcass by thousands of rubber "rivets" to prevent tread separation; and bronze plated steel bead wires. The new tires have a flatter road level profile and are interchangeable for all truck or trailer wheels, single or dual.



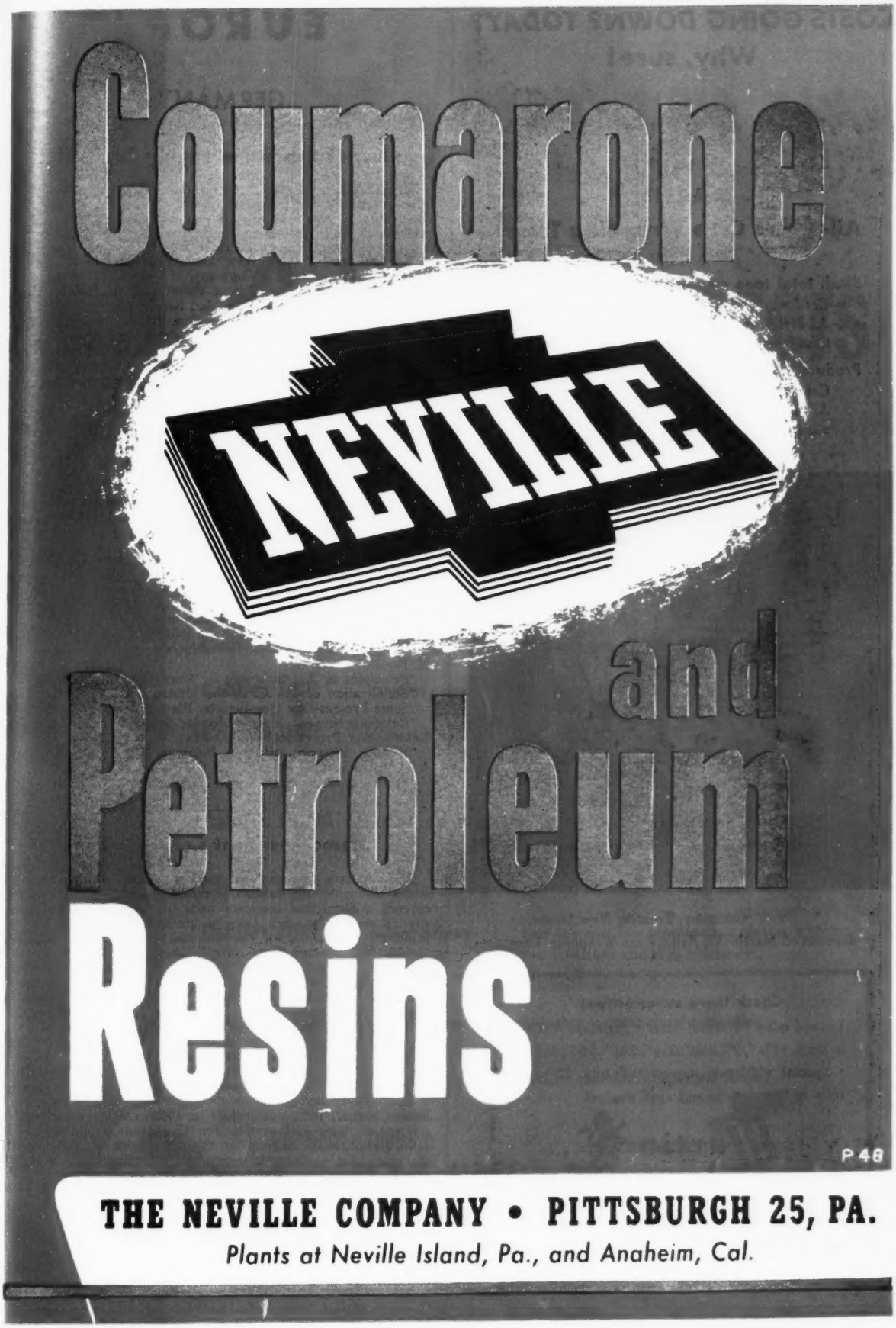
Anaconda ATV-270 Television Lead-In Line

Television Cable

A NEW "all-weather" ultra-high-frequency transmission line of unique construction has been announced by Anaconda Wire & Cable Co., New York, N. Y., for use by the television industry. Known as Anaconda ATV-270, the line serves as a lead-in from roof antenna to television receiver. Developed in conjunction with RCA Service Co., Inc., the new line is said to show the lowest electrical losses under adverse weather conditions of any available design. In addition, the new design provides considerable savings in copper; 1,000 feet uses only one pound of copper to provide the electrical equivalence of co-axial shielded cable consuming 41.5 pounds of copper.

In the construction of the new line, two Copperweld conductors are surrounded by polyethylene spiral threads which act as centering mediums, allowing each conductor to float within its individual extruded polyethylene tube. The twin tubes are again "floated" inside a brown polyethylene jacket which protects them from weathering and mechanical damage. The ATV-270 line is said to be equally reliable over the entire range of both VHF and UHF channels and is claimed to be 55 times as efficient as standard flat ribbon line in delivering voltage at UHF. The jacketed line is approximately ½-inch thick and ¾-inch wide.

"Protection against Rot and Mildew with Milmer 1." Monsanto Chemical Co., St. Louis 4, Mo. 12 pages. Specific application information and test results show the effect of Milmer 1 in combating mildew and rot in textiles, vinyl film and coated fabrics, synthetic rubber products, leather, etc.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Plastics Exhibition Highly Successful

Large numbers of people from various parts of Germany and from practically every country in the western world came to Dusseldorf, October 11-19, to visit the well-planned plastics exhibition and to attend the conference. Not only foreigners, but Germans too, especially those connected with the rubber industry, seem to have been amazed at the rapid advance of the plastics industry in Germany, at the variety of materials and applications. The stream of visitors did not confine themselves to looking and wondering, but bought heavily. Orders for plastics materials and products were booked not only from Germans, but from buyers representing at least a dozen different countries, mostly European. Indeed there are indications that rubber manufacturers were rather rudely awakened by the Fair to the implications for them of continued activity and advances in the plastic field if they did not take suitable action.

Not that several rubber companies had not read the signs in time and had begun to manufacture such plastic goods as they considered likely to offer them serious competition. Among the foresighted may be mentioned Pahlsche Gummi-u. Asbest Gesellschaft and New York-Hamburg Rubber Goods Co., both of whom had stands at the Fair in which they displayed their plastic goods. The former showed various kinds of plastic tubes and hose, coveyors for the food industry, molded goods from the new plastic, Vulkollan, and sheeting from new-type foamed plastics.

The periodical, *Kunststoffe*, issued two special Fair and Conference numbers: the first, that of October, 1952, covers every aspect of the advances made in plastics technology; while the second, that of December, 1952, contains the opening speeches made and reproduces the papers read at the conference—most of them in full. Among the papers the following may be mentioned:

"Thermal Decomposition of Macromolecular Compounds," H. Hopff.

"Principles of Net-Structure in Macromolecules," O. Bayer.

"Stabilization of P.V.C. in the United States," G. B. Mack.

"Some Present-Day Questions on Plastics Testing," R. Nitsche.

"Relations between Macromolecular Structure and Mechanical Deformation Properties," A. V. Blom.

"Viscous Behavior of High Polymers and Polyelectrolytes," A Peterlin.

"Softening of Macromolecular Substances," F. Wirstlin.

Flame-Resistant Conveyor Belts

A few years ago the increased frequency of fires in coal mines following the relatively recent introduction of rubber-covered underground conveyor belts, had suggested the necessity of eliminating such belts in the mines because, while not primarily responsible for the outbreak of fires, the belt helped spread fires started from other causes. It is admitted that conditions in the mines often favor the production of sparks on the surface of the belts or near the belts, and these conditions are being corrected; but rubber belting must be flame-resistant if its use is to be continued.

The mining industry and the belting manufacturers have been collaborating on this problem and recently developed a fabric belt combined and covered with a special flame-resisting neoprene compound which is expected to solve the difficulty. Provisional specifications agreed upon by both parties include a flammability test in which a sample held in the flame of a bunsen burner, with temperature of about 1,000° C. at point of contact of flame and sample, for 15 seconds (for the rubber cover) and for 30 seconds for the fabric core with or without the cover. Flammability is determined according to the time the sample continues to burn after removal from the flame; and for the present a belt is considered flame-resistant if this time does not exceed 240 seconds.

Mechanical tests show that the neoprene belts have better abrasion resistance, but somewhat lower longitudinal flex resistance than natural rubber belts, but it is expected to be able to bring the new belts up to the standard of the usual belts in this respect. Because of the difference in the inherent properties of rubber and neoprene, Shore hardness for the latter is put at 68± 4, instead of 64± 4, for the ordinary rubber belts.

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***Cabflex DDP**	*didecyl phthalate*	new high molecular weight diester imparting remarkably low volatility, water and oil extractability
Cabflex Di-BA	*dibutyl adipate*	non-toxic, approved for use in vinyl food wrappings by Food and Drug Administration
Cabflex Di-OA	*dioctyl adipate*	low cost standard low temperature plasticizer
***Cabflex DDA**	*didecyl adipate*	new low cost, low temperature diester with low volatility and high efficiency

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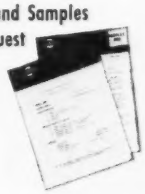

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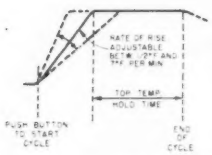

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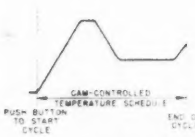

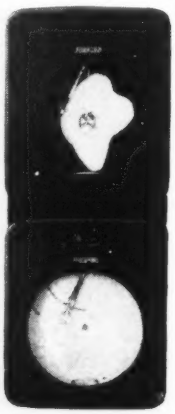

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To Meet Buna Problems

Representatives of the German rubber industry and the Huls Chemical Works have been considering means to solve problems on the continued production and use of Buna here.

It will be remembered that Huls set out toward the end of 1951 to produce 500 tons of Buna monthly; however, the high cost of production, largely due to the fact that butadiene is produced from coal, made it necessary to sell the material at 4.00 marks per kilogram (2.2 pounds), which was considerably above the prevailing price of imported synthetic rubber; consequently a large part of the output remained unsold and accumulated at Huls. To make Buna competitive with imported synthetic rubbers, it was decided on April 1, 1952, that German rubber manufacturers should pay into an equalization fund the equivalent of about 5¢ on every kilogram of natural or imported synthetic rubber they used; at the same time Buna production at Huls was cut from 500 tons to 350 tons a month. As a result, the price of Buna could be reduced to 2.50 marks per kilogram, the accumulated stocks of Buna at Huls began to disappear, only to pile up in the warehouses of the rubber manufacturers because Buna S 3, the type produced, has relatively limited uses.

It is now realized that the Buna problem must be attacked from a technological as well as the economic angle, and discussions have centered on the possibility of producing butadiene more cheaply and of developing other types of Buna useful to the industry, as well as neoprene and butyl rubber. It was revealed that Huls expects to be able before long to produce butadiene from butane instead of coal, whereby the end-materials would be considerably cheaper. Odorless and tasteless Buna S 3 does not appear to have been made yet, but a non-discoloring type has been put on the market and since October 1, 1952, has been selling at the same price as ordinary Buna. Trial batches of cold rubber have been successfully made and have been sent out to manufacturers; but large-scale conversion to this type of rubber requires an investment which Huls does not feel justified in itself undertaking. The same applies to oil-extended rubber, which has been made from Buna S 3. The production of carbon black masterbatches of the Buna is held possible; the situation is considered more complicated with regard to neoprene (desirable for flame-resistant goods) and butyl rubber for inner tubes; but these types will also be given full consideration.

With the cooperation of the rubber manufacturers, Huls is expected to be able to make available before long a useful assortment of German synthetic rubbers, while at the same time Germany will be catching up with the synthetic rubber industry abroad.

Beranit, New Casting Resin

Beranit is a new casting resin put on the market by the firm of Ernst Baer, Heidenheim/Brenz, which is produced by an undisclosed, patented method, by polymerization of crystalline aromatic hydrocarbons. The process is said to yield an amphous and homogeneous mass with the same electrical and thermal properties as the starting material, but it is more impervious to water vapor and has improved mechanical properties. The material can be molded, extruded and machined; it is naturally white and can be dyed; however, to obtain a good black color, such large amounts of pigment are required as to lower tensile strength. Various types of Beranit are available including some suitable for dipping and impregnation; others can be used for casting small series of models, as highly heat-resistant sealing compound, for casting small parts for the electrical industry, etc.

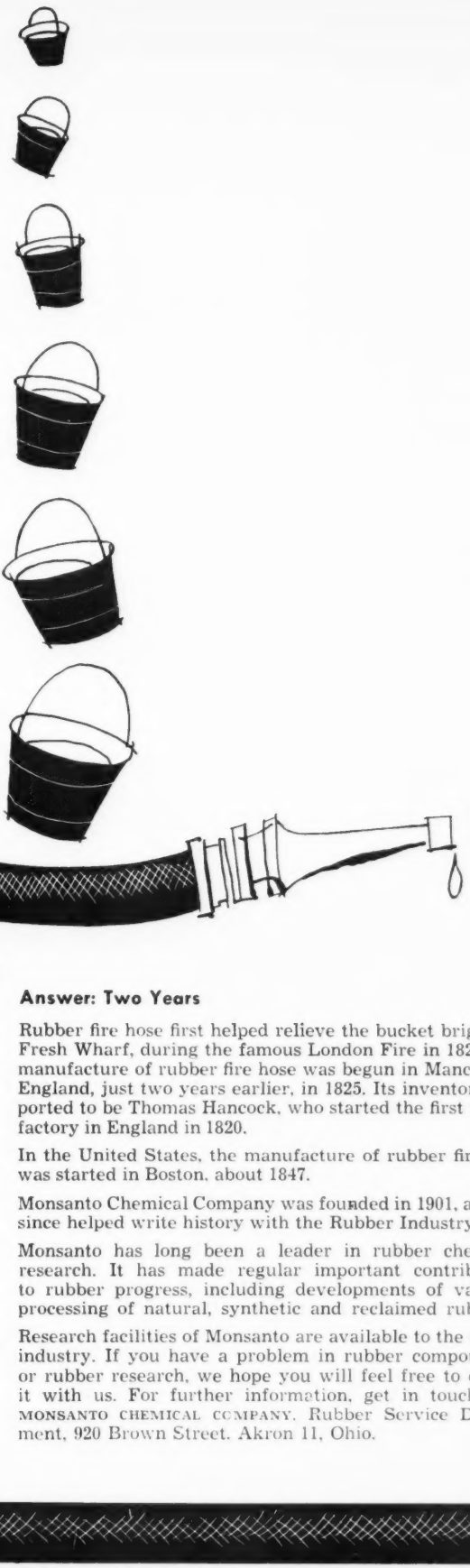
GREAT BRITAIN

Anglo-American Productivity

A successful meeting on Anglo-American productivity, organized by the London Section, Institution of the Rubber Industry, was held in London, November 11. Following the opening address, in which the chairman for the occasion, S. D. Sutton, brought out the importance to British industry of an understanding of the differences between their methods and those of Americans, three papers were presented in which aspects of the

THE HISTORY OF THE RUBBER INDUSTRY — Number 1

how long did it take to get from here to here?



Answer: Two Years

Rubber fire hose first helped relieve the bucket brigade at Fresh Wharf, during the famous London Fire in 1827! The manufacture of rubber fire hose was begun in Manchester, England, just two years earlier, in 1825. Its inventor is reported to be Thomas Hancock, who started the first rubber factory in England in 1820.

In the United States, the manufacture of rubber fire hose was started in Boston, about 1847.

Monsanto Chemical Company was founded in 1901, and has since helped write history with the Rubber Industry.

Monsanto has long been a leader in rubber chemicals research. It has made regular important contributions to rubber progress, including developments of value in processing of natural, synthetic and reclaimed rubber.

Research facilities of Monsanto are available to the rubber industry. If you have a problem in rubber compounding or rubber research, we hope you will feel free to discuss it with us. For further information, get in touch with MONSANTO CHEMICAL COMPANY, Rubber Service Department, 920 Brown Street, Akron 11, Ohio.

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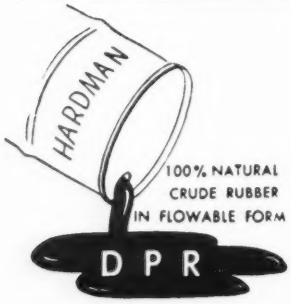

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tire, dipped goods, and mechanical goods industries, respectively, were discussed.

E. Hornby (Firestone Tire & Rubber Co., Ltd.), referring to the tire industry, in the course of his lecture pointed out the difference in the attitude of workers to increased production, the differences in managerial and technical approach to production problems, and also the role here of outside suppliers and engineers.

G. Halstead (Veedip, Ltd.), talking on dipped goods, found that the main handicap in the United Kingdom was that here many factories catered to a relatively small market whose requirements did not justify many of the labor-saving devices used in American factories. He also suggested that British manufacturers should be more ready to adapt themselves to improved methods.

The advantage the American manufacturer had over his British opposite in the mechanical goods industry, M. M. Heywood (P. B. Cow & Co., Ltd), emphasized was that the former could buy in quantity, and that the savings thus effected in costs made for further reduction in costs, by permitting increased investment in more modern plants.

British Rubber Industry Notes

Restricted overseas markets for cars and slow sales at home caused a piling up of tires at Dunlop's factory in Birmingham and led to a cut in the work-week from five to four days for about 3,500 workers in the tire section in November. About two weeks later some 1,500 resumed the five-day week.

What is claimed to be the world's fastest tire-testing machine has been designed and built at Fort Dunlop to reproduce landing, taxi, and take-off conditions for jet-aircraft tires. Behind a safety curtain of steel torpedo netting in the new high-speed test-house, tires of from 17 to 37 inches tread diameter are tested under loads up to eight tons and speeds up to 300 miles an hour.

While airplane tires have until recently been designed for pressures around 75 pounds per square inch and ground speed of 100 miles an hour, Dunlop is now developing a much smaller tire to work at a pressure of 200 pounds per square inch and for ground speed of 220 miles per hour, it was revealed.

The thirty-first general annual meeting and dinner of the Institution of the Rubber Industry took place in London on December 11, with Sir Clive Baillieu, presiding. On this occasion the Colwyn Medal for the year was presented to Geoffrey Gee, director of the British Rubber Producers' Research Association. Dr. Gee in 1951 received the honor of being elected a Fellow of the Royal Society.

The Hancock Gold Medal, awarded for services to the industry not necessarily of a scientific nature, was presented to T. J. Drakeley, principal of Northern Polytechnic.

At this meeting, Sir Clive Baillieu and S. D. Sutton, were reelected president and vice president, respectively, for 1952-53.

After the British Bata Shoe Co. resigned last fall from the Rubber Footwear Manufacturers' Association and cut its prices by 20%, sales of Bata rubber footwear increased to such an

Abrasion Resistance!
SEE PAGE 580

Bags treated with DOW CORNING Silicone Lubricants make better tires

Moe Muscles knows how easy it is to handle bags properly treated with Dow Corning Emulsions. They slip smoothly into place and they come out without sticking. Same's true when he gets green carcasses treated with a solvent solution of Dow Corning Mold Release Fluid and talc.

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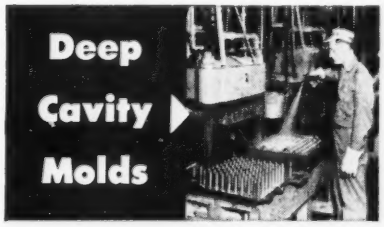

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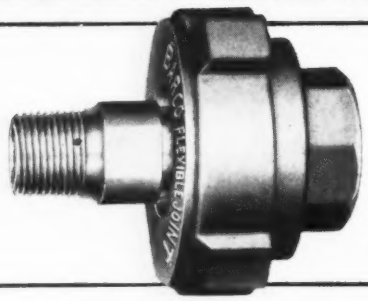

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extent that the production schedule had to be changed to permit greater output, it is learned.

A silver anniversary celebration combined with receipt of the National Safety Council's Award of Honor was held by Goodyear Tyre & Rubber Co. of Great Britain, Ltd., on December 15 at Wolverhampton. The English plant worked 5,077,830 man-hours from February 15 to October 10, 1952, without a disabling injury.

FRANCE

Rubber Imports and Consumption

During 1951, France imported 136,602 tons of rubber, excluding sole crepe, but including 10,230 tons of rubber from North America (presumably synthetic rubber). Of the balance, Malaya supplied 75,031 tons; Indo-China, 30,732 tons; Indonesia, 15,494 tons; and 4,575 tons from other sources. These figures compare with a total of 102,483 tons in 1950, of which 6,189 tons came from North America; 15,396, from Indo-China; 69,011, from Malaya; 10,024, from Indonesia; 1,863 from other areas.

The 1951 increase in imports from Indo-China (almost 100% greater) and from North America (more than 60%) are particularly noteworthy. Statistics for the early months of the current year indicate a continuation of this trend, especially with regard to North American shipments (synthetic).

Consumption of crude rubber in 1951 totaled 109,071 tons, of which synthetic rubber accounted for roughly 10%. Details of the amounts used for various products that year reveal that butyl rubber, which accounted for about ⅓ of the synthetic rubber consumption, is finding increasing use in the manufacture of inner tubes for automobile tires. The other types of synthetic rubber seem to find their greatest single outlet in the footwear industry, especially for soles and heels.

The tire industry used 83,997 tons of all kinds of rubber in 1951, against 66,344 tons in 1951, with 63,848 tons (against 50,905) going into automobile tires.

Other rubber products required 52,214.4, against 42,726.8 tons. The branches showing greatest increases in rubber consumption during the year under review were: footwear (9,676.8, against 7,577.6 tons); heels and soles (7,219.8, against 5,113.1 tons); mechanical goods (9,509.1, against 7,469.6 tons); insulated cables (4,313.6, against 3,358.4 tons); belting (3,701, against 2,228.3 tons); hose (3,567.7, against 3,000.6 tons); thread (767.4 against 632.7 tons); sanitary and surgical goods (1,321.1, against 1,057.3 tons).

Consumption decreased for rubberized fabrics (2,400.6, against 2,884.8 tons); sponge and cellular rubber (2,647.6 against 3,034.3 tons); toys and sporting goods (836, against 1,040 tons); and artificial leather (1,211.5 against 1,383.5 tons).

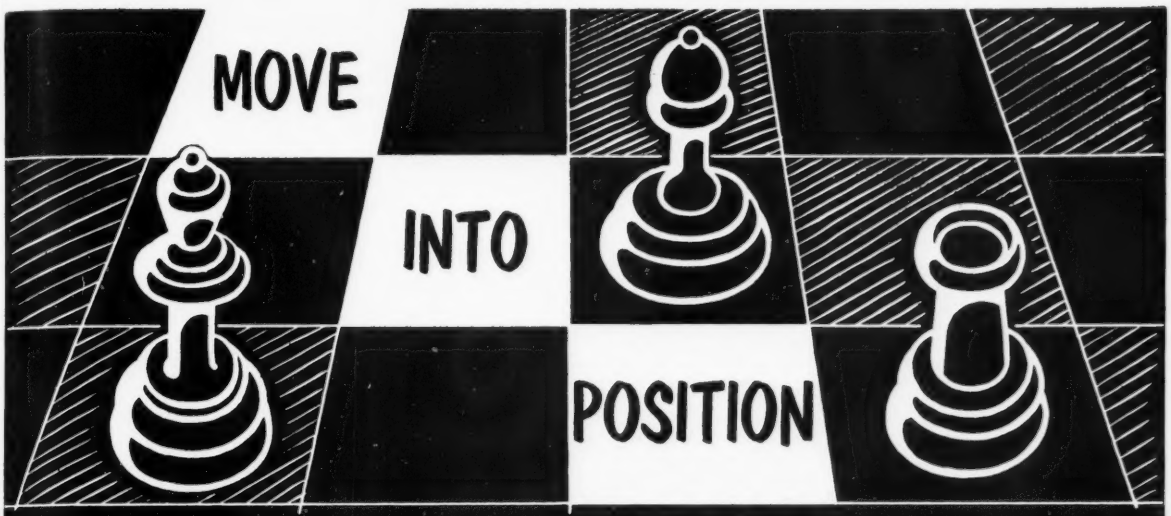
Rubber Trade Notes

At a meeting of the French Association of Engineers of the Rubber Industry held in Paris on October 30, 1952, terminology was discussed, and it was decided to adopt the generic term "Elaston" to designate any kind of synthetic elastomer (instead of "synthetic rubber-like elastomer").

A study group for synthetic rubber is reportedly to be set up by various French firms prominent in the chemical, rubber, and petroleum industries. Apparently it is planned eventually to erect a plant for producing butyl rubber. It is understood that the group is to be represented by a French subsidiary of the Standard Oil Co. of New Jersey.

Produits Caoutchouc du Centre, manufacturer of rubber goods, Chignat-Vertaizon (Puy-de-Dome), is interested in being licensed by an American firm for the manufacture and distribution in France of new products and articles suited to the firm's facilities, which consist of a modern boiler house, five mixers, two mangling machines, ten vulcanizing presses, one pumping station, three automatic presses for rubber cutting, six autoclaves, one extruding press, molds, and various apparatus and appliances.

Elisom S. A. R. L., manufacturer of molded electrical fittings, 54 Ave. Daumesnil, Paris, also seeks a license from an American firm, for the manufacture and distribution in France of electrical appliances and fittings molded of rubber, vinylic, silicon, or other molding materials.



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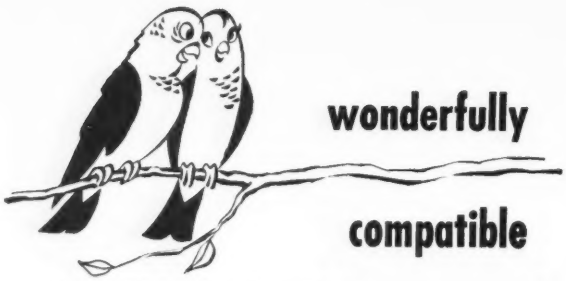

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FAR EAST

MALAYA

For Better Shipping and Packing

The Malaya Rubber Shipping and Packing Ordinance came into force in Singapore on January 1, 1953, and in the Federation of Malaya on February 1, 1953. A circular which gives details regarding the rules of the Ordinance and the objects and methods of the Malayan Rubber Export Registration Board has been issued. The Ordinance provides that all shippers and packers must be registered with the Board and obtain a valid certificate—one for each place of business. The names, marks, house symbols, by which their bales and packages are generally recognized must also be registered, and where symbols are used on bales and packages to indicate grades, these symbols and the grades they represent must also be registered. It is hoped in this way to insure that the contents of a bale or package of rubber for export conforms with contract and with marks shown on them; traders guilty of malpractices will be appropriately dealt with. It is pointed out, however, that the Board will not take action where minor deviations from contract, inseparable from trade in rubber, are involved. If necessary, the Board will send representatives to make on-the-spot investigations of claims.

It is hoped that Rubber Trade and Rubber Manufacturers associations will give their fullest cooperation to insure efficient working of the measure.

In view of complaints that in the past there have been unfair claims on rubber shipments at the port of destination and that in many cases these claims have not been justified, though they have been paid, it has been suggested that in future all claims made and paid on rubber shipments should be endorsed on the relative documents so that consumers will know and receive such allowances or claims. It is thought that such a procedure might help eliminate unjust claims.

In connection with bad shipments, we note a letter by E. G. Holliday, chairman of the Singapore Chamber of Commerce Rubber Assoication, addressed to W. S. Lockwood, of the Natural Rubber Bureau, and appearing in *Natural Rubber News* for January, 1953, in which responsibility for malpractices in the rubber trade is discussed.

Mr. Holliday traces the beginnings back to the latter half of 1945 when there was an accumulation of rubber stocks in Malaya which had to be moved fast, a consequent licensing as packers for export of a number of totally inexperienced small traders on the Malayan side, and over against this condition, importers anxious to supply a world-wide hunger for natural rubber and careless of the status of the exported in Malaya.

The smaller packers would have disappeared after a time, says Mr. Holliday, if importers from various markets, especially New York, had not encouraged them to ship to order, with the result that malpractices crept in on both sides. He cites a case in which a self-styled rubber importer in the United States, attempted to have a firm—not a member of Mr. Holliday's association—ship to New York, as No. 4 sheet, 100 tons of rubber actually including 50% of No. 5 sheet and 50% No. 4 sheet; arrangements would then be made in New York to have only the No. 4 sheet examined, and the profits would be divided. The Singapore exporter figured that perhaps only the No. 5 sheet might be examined, and the deal fell through.

Mr. Holliday visited Japan in December to discuss rubber trade between that country and Malaya. The question of bad shipments, of which Japan had been complaining bitterly two months earlier, was to have been threshed out, and at the same time the provisions of the new Rubber Shipping and Packing Ordinance were to have been explained to the Japanese.

The Institution of the Rubber Industry

LONDON

THE RUBBER INDUSTRY owes its development largely to scientific and technical research and the Institution was founded in 1921 to foster scientific and technical advancement and to disseminate the results.

THE INSTITUTION TODAY is the centre of a great fraternity of rubber manufacturers, scientists, technologists, research establishments, executives and students from every country whose object is the advancement of the cause of the rubber industry throughout the world.

OBJECTS: To promote corporate and concerted effort in the industry by bringing together all those engaged or interested in the various branches of science and technology on which the Industry is based and co-ordinating their respective contributions.

To promote the profession and practice of Rubber Technology.

To encourage the extension of scientific and technical education in the principles and details of rubber manufacture.

To maintain a scheme of Diplomas for the recognition of efficiency in knowledge of all branches of technology essential to the successful maintenance and development of rubber manufacture.

To arrange for the holding of meetings, the reading of papers and the giving of lectures with subsequent discussions and publication.

To foster the systematic study of scientific and technical problems involved in the various phases of the manufacture of natural and synthetic rubbers and rubber-like materials and their conversion into finished products.

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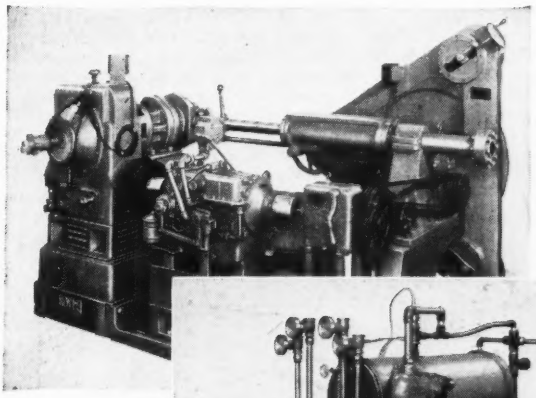

↑ Royle #2 (3¼") Continuous Vulcanizing Extruder for room temperature compound process.

→ Royle extruder temperature control unit utilizing steam and hot water.

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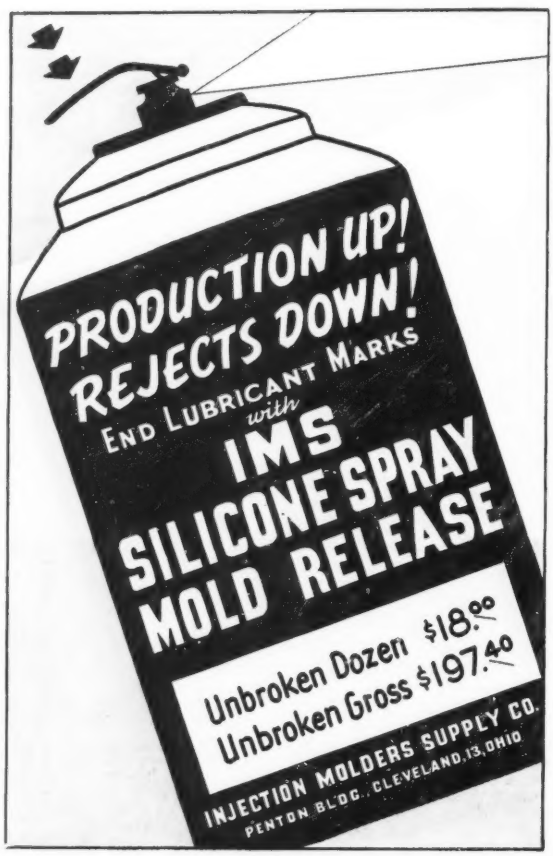

Notes from Malaya

Malaya's scheme for replanting 500,000 acres of old rubber on smallholdings with high-yielding material by 1959 has now been put into action. It is expected that if the trees are properly cared for, yields on smallholdings will be trebled or quadrupled. Under the scheme, grants are provided for replanting up to one-third of the acreage owned by an applicant, though owners of less than six acres may be permitted to replant up to three acres of land; but no grants will be given for replanting holdings of less than one acre.

The first payments under the terms of the plan were approved at the end of last December when it was decided, as an interim step, to distribute $166,000 among 425 smallholders who will replant 1,380 acres in Malacca. Initial planting is expected to be completed by April. Malacca has been the first state to receive payments because it is the only one where applications by replanters have been checked. It is understood that replanting officers have already been appointed in most of the states of the Federation.

A number of associations of rubber traders in the Federation of Malaya are said to have invited those in Singapore to join them in forming a Pan-Malayan Rubber Trade Association. They would open offices in New York and London with the aim of developing closer relations with American and British buyers; they would deal on the spot with claims on Malayan rubber shipments and protect the interest of buyers and packers alike.

Malaya has for some time also been experimenting with the use of rubber powder in asphalt for road surfacing, and trial sections of such roads have been laid in Penang, Singapore, and Kuala Lumpur. Quite recently another stretch of road was surfaced in this way in the last-named city. The rubber powder used is produced locally; Malaya and Indonesia are the only two countries where natural rubber powder is at present produced. In Malaya the manufacturers are Cressonite Industries in Singapore, and the experiment station of the Rubber Research Institute at Sungei Buloh. Between them, the two countries are estimated to have supplied about 1,000 tons of rubber powder for roads to consumers abroad.

Early in December the Sungei Buloh experiment station was able to send a third shipment of cyclized rubber to England, where it will be compared with the British product. About 500 pounds of this material have now been produced at Sungei Buloh, and the indications seem very favorable for commercial production of cyclized rubber in Malaya.

INDIA

Goodyear Tire & Rubber Co. of India, Ltd., in 1952 celebrated its thirtieth anniversary in India. Starting in 1922 with four products, the concern now makes more than 90 different items.

Under the terms of the Indo-Egyptian Trade Agreement, resumed for another year, starting March, 1952, India is to supply rubber tires and tubes (except giant tires) to a value of £20,000.

AUSTRALIA

P. B. Cow, of London, England, together with Leggett Products Pty., Melbourne, have formed a company to manufacture and sell in Australia specialized rubber products of the English company and its subordinates. The new firm, which has an authorized capital of £250,000, is to be known as P. B. Cow (Australia) Pty.

"Polygard Stabilized GR-S." Bulletin No. 190. Naugatuck Chemical Division, United States Rubber Co., Naugatuck, Conn. 6 pages. Data compare Polygard with amine and phenolic-type stabilizers in GR-S polymers with regard to staining, resinification, gel build-up, retention of viscosity, and tensile properties. A table also shows the compositions, properties, and applications of GR-S polymers stabilized with Polygard.

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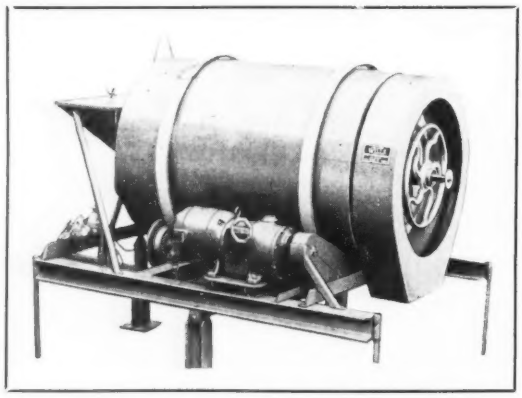

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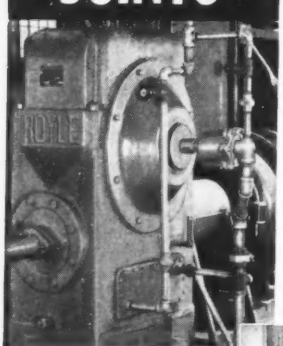

When it comes to admitting heating or cooling agents to rotating rolls or drums, the Johnson Joint completely outmodes the old style stuffing boxes. It saves enough in reduced maintenance alone to pay its own way quickly—it is completely packless, self-lubricating, self-adjusting and even self-aligning. In addition, it can materially benefit over-all production—by ending many causes of machinery shut-down, by its more efficient performance, by facilitating better roll drainage.

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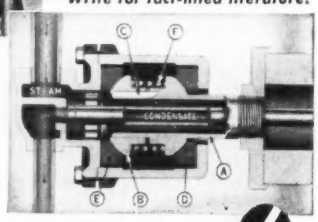
Johnson Joint installed on rubber extruder. Photo courtesy of Manhattan Rubber Div., Raybestos-Manhattan, Inc.



Rotating member consists of Nipple (A) and Collar (B), keyed together (C). Seal ring (D) and bearing ring (E) are of self-lubricating carbon graphite. Spring (F) is for initial seating only; joint is pressure sealed in operation.

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Editor's Book Table

BOOK REVIEWS

"Fundamental Principles of Polymerization: Rubbers, Plastics, and Fibers." G. F. D'Alelio. John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Cloth, 6 by 9 inches, 527 pages. Price, $10.

This book summarizes the minimum fundamental knowledge that a scientist in the field of polymers should have, particularly in view of the rapid expansion in the polymer field during the past few years. While the author gives an outline of basic processes, the text concentrates on fundamental aspects rather than the technology of applied polymerization. Sufficient historical data are given to show the development of the field, and polymer research during the past few decades is reviewed and evaluated. In addition, the author attempts to eliminate confusions and discrepancies in polymer terminology by establishing a series of exact definitions, clearing up misunderstandings in terminology, and setting up some new terms to define hitherto indefinite phases.

There are 10 chapters. The first deals with a discussion of the states of matter and classifies polymers according to the rubber, plastic, and fiber states. Successive chapters cover polymerization reactions and functionality; an analysis of the existence of macromolecules; non-homogeneity of polymers and their properties; inter—and intramolecular reactions; polymerization processes; molecular weight determinations; kinetics of polymerizations; reaction loci in polymerization systems; and copolymer compositions and stability of polymers. Both author and subject indices are included in the book.

"Colloid Science. Volume I. Irreversible Systems." Edited by H. R. Kruyt. Elsevier Press, Inc., 402 Lovett Blvd., Houston, Tex. Cloth, 6½ by 10 inches, 409 pages. Price, $11.

This volume completes the work begun with the publication of Volume II (on reversible systems) in 1949. While not a complete treatise on the subject, this book is intended as a guide to colloid science, with the aim of providing a stimulus to further research. The topics covered are classified according to general phenomena, and not according to substances or systems. Contributors to this volume are Dr. Kruyt, G. H. Jonker, and J. Th. G. Overbeek. Section headings are as follows: general introduction; phenomenology of lyophobic systems; optical properties of colloidal solutions; electrochemistry of the double layer; electrokinetic phenomena; the interaction between colloidal particles; kinetics of flocculation; stability of hydrophobic colloids and emulsions; and rheology of lyophobic systems. The book includes a list of symbols used, and both author and subject indices.

"Encyclopedia of Surface-Active Agents." J. P. Sisley. Translated from the French and revised by P. J. Wood. Chemical Publishing Co., Inc., 26 Court St., Brooklyn 2, N. Y. Cloth, 6 by 9 inches, 544 pages. Price, $15.

Of interest to every user of wetting agents, detergents, penetrants, foaming compounds, emulsifiers, and dispersing agents, this book presents concise information on more than 2,500 commercially available surface-active agents manufactured both here and abroad. The contents are divided into two parts, the first of which deals with the general aspects of these materials their properties, applications, and methods of manufacture. The author also presents an efficient system of classification by which every variety of modern surface-active agent can be identified by simple symbols. The second part of the book consists of an alphabetical listing of the materials by trade names, with the composition, manufacturer, properties, classification, pH, and applications given for each material.

NEW PUBLICATIONS

"Darex Plasticizer DBM." Bulletin W-5. Dewey & Almy Chemical Co., Cambridge 40, Mass. 1 page. This bulletin offers data on the specifications, properties, and applications of the company's dibutyl maleate plasticizer.

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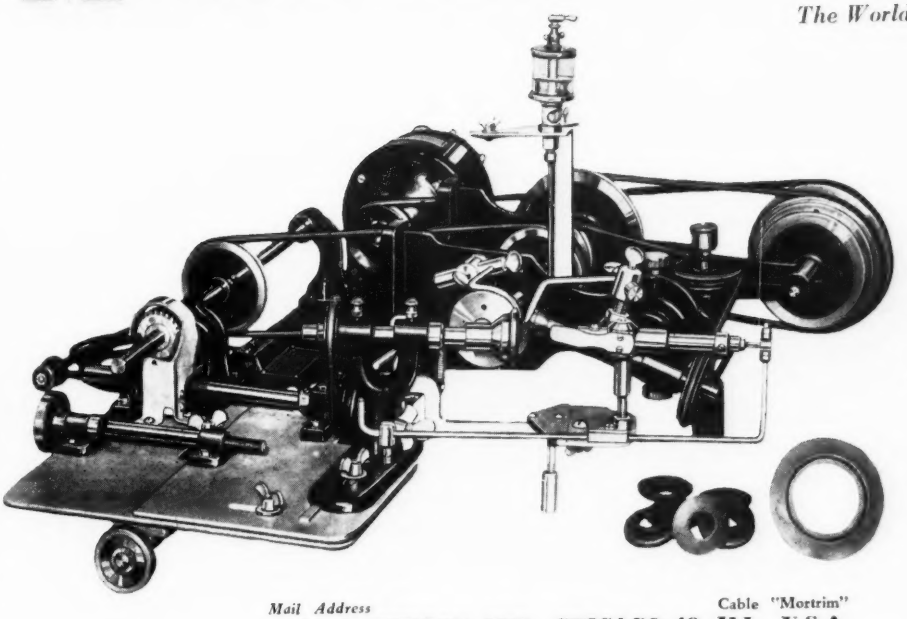

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"R. D. Wood Co." R. D. Wood Co., Independence Sq., Philadelphia 5, Pa. 32 pages. Reissued in conjunction with the company's one hundred fiftieth anniversary, this illustrated booklet describes the firm's facilities, methods, and equipment for the manufacture of hydraulic presses and valves.

"Witco Stabilizer #90." Technical Service Report S-7. Witco Chemical Co., 260 Madison Ave., New York 17, N. Y. 2 pages. Properties and applications are given for the stabilizer, designed for use in vinyl plastic film and sheeting applications where non-toxicity is a requirement. The product is also suitable for use in extruded, molded, and vinyl plastisol stocks.

"B. F. Goodrich Caricoal Belts." B. F. Goodrich Co., Akron, O. 18 pages. This illustrated catalog describes the company's new rubber covered belts for coal conveyors. Design features and specifications of the belts are given, together with information on belt selection and maintenance.

"Paracril Nitrile Rubbers: Curatives and Antioxidants in Paracril." Technical Bulletin No. 6. Naugatuck Chemical Division, United States Rubber Co., Naugatuck, Conn. 14 pages. Detailed information and laboratory test data are presented on the effects of various accelerator systems in Paracril, and the effect of antioxidant at varying sulfur levels.

Bulletins of Harwick Standard Chemical Co., 60 S. Seiberling St., Akron 5, O. #19-173-0-11-52. **"Actogen."** 4 pages. #19-172-0-11-52. **"Ko-Blend I. S."** 2 pages. #12-171-0-11-52. **"Gen-Tac Resin."** 3 pages. These respective reports give the properties and uses of Actogen, a dibutyl ammonium oleate activator for use with thiazole and thiuram accelerators; Ko-Blend I. S., a GR-S masterbatch with 85% insoluble sulfur for control of sulfur bloom; and Gen-Tac Resin, a phenol-formaldehyde resin for improving adhesion of rubber to fabric.

"Stucco Finishes Made with Pliolite S-5." Goodyear Tire & Rubber Co., Akron, 16, O. 18 pages. This manual provides complete information on the use of Pliolite S-5 in stucco paints. In addition to resin properties and grades, detailed formulations appear for various types of stucco, masonry, shingle, brick, and related paints containing the resin.

"Industral Disc Brakes by Goodyear." 8 pages. This illustrated booklet describes the development and features of the firm's airplane type disk brake and shows some of the varied industrial applications for the brakes.

"Caustic Soda." Wyandotte Chemicals Corp., Wyandotte, Mich. 56 pages. Of interest to every user of caustic soda, this booklet presents data on grades, manufacturing processes, analytical methods, shipping, freight rates, unloading and handling, containers, and materials of construction for processing and storage equipment.

"Fatty Acids Prepared for Action from Nature's Chains." Association of American Soap & Glycerine Producers, Inc., 295 Madison Ave., New York 17, N. Y. 20 pages. This booklet presents information on the preparation and uses of fatty acids. Descriptions of common terms and tests are also included, together with methods of handling and suitable materials of construction.

"Hi-Sil C." Pigment Data Bulletin No. 52-7. Columbia-Southern Chemical Corp., Fifth Ave. at Bellefield, Pittsburgh 13, Pa. 1 page. Detailed data cover the properties of Hi-Sil C, a hydrated silica of extremely fine particle size for use as a non-black reinforcing agent for rubber.

"Dow Corning 4 Compound, Properties and Application in the Electrical Power and Other Industries." Silicone Notes #4-201. Dow Corning Corp., Midland, Mich. 4 pages. Information is given on the properties and uses of Dow Corning 4 Compound, a grease-like silicone material suitable for use as a dielectric paste, water repellent and seal, corrosion inhibiter, and lubricant and preservative for rubber, plastics, and leather.

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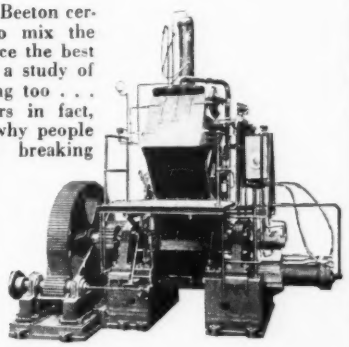

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"Colloidal Carbon—Invaluable Soot." Vol. XI, No. 4. Carl W. Sweitzer. Columbian Carbon Co.; Binney & Smith Co., 41 E. 42nd St., New York 17, N. Y. Columbian Colloidal Carbons, 30 pages. Reprinted from the *Journal of Chemical Education*, this article describes the manufacture, properties, and applications of the various carbons, including rubber, ink, and pigment grades.

"Rubber—Fourth Annual Report by the Secretary of Commerce, U. S. Department of Commerce." United States Government Printing Office, Washington 25, D. C. 20¢. 48 pages. This report for the period July 1, 1951, to June 30, 1952, as required by the Rubber Act of 1948, includes a review of operations under this Act to the President and the Congress. No new information is contained in the booklet, which has sections on such subjects as "International Framework of U. S. Rubber Operations," "Synthetic Rubber Plant Expansion and Prices," and "United States Rubber Position." Nineteen tables on production, consumption, and stocks of natural and synthetic rubbers, tires and tubes, etc., through June, 1952, are useful for future reference.

"Pratt & Whitney Continues Gages and Control Units." Pratt & Whitney Division, Niles-Bement-Pond Co., West Hartford, Conn. 28 pages. Illustrations and descriptions appear of the company's electronic, magnetic, and beta-ray continuous thickness gages, as well as their control units and accessory equipment.

"Neoprene Notebook." No. 52. November, 1952. E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. 8 pages. This issue of the Notebook features an article describing the ASTM system for specifying cellular rubber products. Other stories describe the use of neoprene in air hose, valve shields, filters, hot sand belts, oil seals, and shock mounts.

"Technically Classified Natural Rubber—Users' Information Circular No. 3." November, 1952. The International Rubber Research Board, 19 Fenchurch St., London, E.C. 3, England. This circular gives an account of consumers' reports on T. C. Rubber obtained during the six months to November, 1952. Consumers are finding the modulus test a successful basis for classification, but the Mooney viscosity test does not provide useful information, it was said. Low-elongation testing is more reproducible in modulus work. It is also pointed out that rubbers can differ markedly in modulus, but not in rate constants of vulcanization and *vice versa*, and this point brings up the question of whether modulus or rate-constant is more important to consumers.

"Technically Classified Natural Rubber—News Sheet No. 5—New Developments," December, 1952. Classification on the basis of Mooney viscosity has been suspended as of December 31, 1952. Nine technical classes have therefore been reduced to three, although the rubber will still carry the circle mark denoting average Mooney viscosity without having the significance of the 73 to 87 Mooney value.

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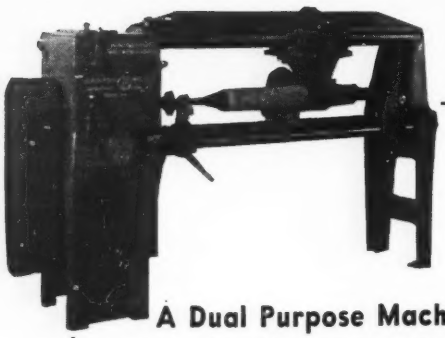

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BROOKLYN COLOR WORKS INC.,

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WANTED: CHEMIST EXPERIENCED IN CAMELBACK PRODuction; molded goods also helpful. Send outline of experience and approximate salary range requirement. Our employes know of this advertisement. Address Box No. 1251, care of INDIA RUBBER WORLD.

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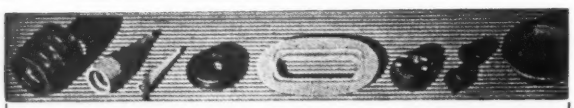

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Polymerization Recipes for 41° F. Sugar-Free Redox Systems. V. C. Neklutin, C. B. Westerhoff, L. H. Howland, *Ind. Eng. Chem.*, May, 1951, p. 1246.

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Guayule Rubber

(*Continued from page* 640)

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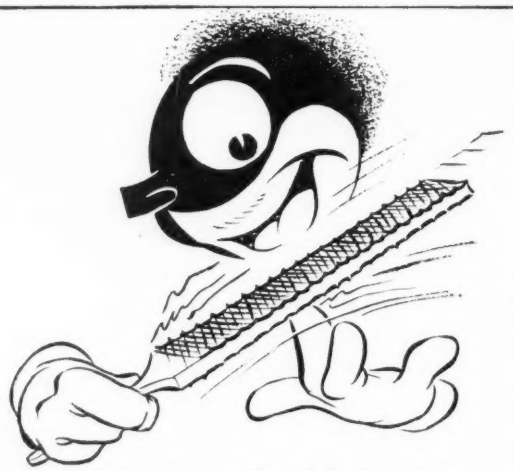

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(*Classified Advertisements Continued on Page 715*)

MARKET REVIEWS

RUBBER

QUIET, irregular trading was noted in the physical rubber market during the period from December 16 to January 15. While offerings were plentiful, factory demand for rubber was poor except for flurries when prices dropped. Trade observers believe that factories had bought rubber in excess of their actual requirements during the buying spree late in November and now have sufficient stocks to carry them over the month of January, at least.

NEW YORK SPOT MARKET
WEEK-END CLOSING PRICES

	Oct. 25	Nov. 29	Dec. 20	Dec. 27	Jan. 3	Jan. 10
R.S.S.: #1	27.75	31.75	31.00	32.00	32.00	30.75
2	26.00	30.75	29.75	31.00	31.00	29.75
3	25.00	29.75	28.75	30.00	30.00	28.75
Latex Crepe:						
#1 Thick	36.50	39.75	30.50	39.75	39.75	38.50
1 Thin	36.50	39.75	39.50	39.75	39.75	38.50
#3 Amber Blankets	24.25	28.50	28.50	29.25	29.25	28.50
#2 Thin Brown Crepe	23.00	27.25	27.50	28.25	28.25	27.50
Flat Bark	22.00	26.25	25.75	26.75	26.75	25.75

The spot price for #1 Ribbed Smoked Sheet started the period at 30.75¢, rose to a high of 32.00¢ on December 26 to January 2, and then fell back to a low of 29.25¢ on January 14-15. The December monthly average spot prices for certain grades follow: #1 R.S.S., 31.70¢; #3 R.S.S., 29.59¢; #3 Amber Blankets, 28.83¢; and Flat Bark, 26.51¢.

COMMODITY EXCHANGE
WEEK-END CLOSING PRICES

Futures	Oct. 25	Nov. 29	Dec. 20	Dec. 27	Jan. 3	Jan. 10
Mar.	26.65	30.25	30.30	31.40	31.25	29.45
May	26.20	29.15	29.10	29.80	30.15	28.70
July	25.80	28.70	28.60	29.30	29.30	28.00
Sept.	25.80	28.30	28.15	28.90	28.95	27.55
Dec.	....	28.30	27.60	28.40	28.50	27.00
Mar.	....	....	27.60	28.40	28.50	27.00
Total weekly sales, tons	2,310	4,180	2,720	740	270	1,220

Trading in rubber futures on the New York Commodity Exchange followed the lead of the spot market during the period. The market was generally dull and quiet, although there were some sales flurries reflecting activity in the spot market. The low level of business is shown by the total of 3,070 tons sold during the second half of December in the #1 Contract, and 4,090 tons sold during the first half of January. Total December sales were 10,660 tons. While there were no sales under the #3 Contract during the second half of December; a total of 250 tons were sold under this contract during the first half of January. Indications were that total sales of #1 futures contract rubber for January would be even lower than the December figure.

Futures prices showed the same rise and fall as spot prices. March futures in the #1 Contract started the period at 29.40¢, rose to a high of 31.40¢ on December 26 and 30, and then dropped back to end the period at a low of 28.25¢. Other futures prices showed corresponding movements. Futures prices in the #3 Contract were somewhat more sluggish and moved at differentials of about 1.50-2.00¢ under corresponding #1 Contract prices.

Latex

THE supply situation for *Hevea* stocks continued tight during the period from December 16 to January 15. Nearby stocks are non-existent, and the efforts of one or two of the larger foam manufacturers to obtain sizable quantities for delivery by March or April have exerted a bullish influence on the market. Many consuming plants are said to be operating on such tight schedules that steamer delays create brief but intense shortages.

All indications are that, barring any severe price changes, the tight *Hevea* supply situation will continue well into the year. Even greater demand for latex is also anticipated as the result of contemplated or already begun expansions in foam products manufacture. While synthetic latex is of good enough quality to capture about 30% of the latex consumption market, these expansions in consumption facilities are expected further to tighten the natural latex picture.

While statistics indicate that the potential world production is almost double the present rate, latex producers are reluctant to make substantial increases unless they can obtain sufficient long-term contracts to minimize their investment risks. On the other hand, the sensitive nature of the natural latex market and its past history of gluts and famines make consumers hesitant in any long-term commitments.

The natural latex market during the recent past has shown that prices of 40¢ a pound, dry solids, or higher markedly decrease buying interest by foam products manufacturers. Long-term contracts are said to be available at differentials of under 11¢ over the spot price for #1 smoked sheets when the latter is under 30¢ a pound. The price for natural latex for nearby delivery is currently reported at 40-44¢ a pound.

Final October and preliminary November domestic statistics on *Hevea* and synthetic rubber latices follow:

(All Figures in Long Tons, Dry Weight)

	Production	Imports	Consumption	Stocks
Natural latex:				
Oct.	0	4,890	5,911	6,314
Nov.*	0	5,000	5,162	5,430
GR-S latices:				
Oct.	3,511	233	4,209	3,652
Nov.*	3,856	238	3,508	4,214
Neoprene latex:				
Oct.	679	0	763	1,081
Nov.*	689	0	622	896
Nitrile latices:				
Oct.	440	0	303	621
Nov.*	494	0	295	698

*Preliminary.

SCRAP RUBBER

THE scrap rubber market reported continued good business during the period from December 16 to January 15. Both dealers and reclaiming mills appeared satisfied that the present price structure is fairly stable, and contracts were placed both in the East and Akron. Most shipments of scrap were confined to mixed auto tires despite resentment by dealers of the reclaimers' insistence that such shipments contain at least 30% of truck and bus casings. Penalties as high as $3 a ton were reported against suppliers who did not meet this minimum requirement. The scrap tube market was centered around black tubes, and red tubes were said to be scarce. Little business was done in peelings since dealers did not find it profitable to sort out the grades, particularly in cold and inclement weather.

Following are dealers' selling prices for scrap rubber, in carload lots, delivered to mills at the points indicated:

	Eastern Points	Akron, O.
	(Per Net Ton)	
Mixed auto tires	$9.00	$12.50/ $13.50
S. A. G. auto tires	Nom.	Nom.
Truck tires	Nom.	12.00/ 13.00
Peelings, No. 1	40.00	40.00
2	Nom.	25.00
3	20.00	20.00
	(¢ per Lb.)	
Auto tubes, mixed	3.00/ 3.25	3.50/ 3.75
Black	3.50	3.50
Red	9.50/ 10.00	9.50/ 10.00
Butyl	2.75/ 3.00	2.75/ 3.00

RECLAIMED RUBBER

A GOOD level of activity was reported in the reclaimed rubber market during the period from December 16 to January 15. Despite the usual year-end lull for inventory purposes, the actual on-order position for reclaim was equivalent or slightly better than the preceding month. The outlook for January and February indicates a further increase in demand for reclaim owing to expanding automobile production, although the lower prices for rubber have given rise to some uncertainty in the market.

While demand for reclaim from the tire and tube manufacturing industry was strong, battery box manufacturers reduced their orders as they entered their usual slack season. In line with the increase in automotive parts production, renewed and expanded demand for reclaim came from cement and adhesive makers.

Final October and preliminary November statistics on the domestic reclaimed rubber industry are now available. October figures in long tons, are: production, 27,405; imports, 207; consumption, 26,830; exports 806; and month-end stocks, 31,463. Preliminary November figures, in long tons, follow: production, 22,264; imports, 242; consumption, 22,587; exports, 833; and month-end stocks, 29,486.

Prices for red tube reclaim and light-colored pure gum floating reclaim were advanced to 24.25¢ a pound from their previous levels of 22¢ and 23¢, respectively. Prices for other grades were unchanged.

Reclaimed Rubber Prices

	Lb.
Whole tire: first line	$0.10
Fourth line	.0875
Inner tube: black	.15
Red	.2425
Butyl	.125
Pure gum, light colored	.2425
Mechanical, light colored	.135

The above list includes those items or classes only that determine the price basis of all derivative reclaim grades. Every manufacturer produces a variety of special reclaims in each general group separately featuring characteristic properties of quality, workability, and gravity at special prices.

CLASSIFIED ADVERTISEMENTS

Continued

MACHINERY AND SUPPLIES FOR SALE (Continued)

FOR SALE: 1—BALL & JEWELL NO. 1½ ROTARY CUTTER, Stainless steel 4—Mikro pulverizers #1-SH, #1-SI, #2-SI, #2-TH. 2—Kux rotary pellet presses. 4—Stokes D-3 rotary pellet presses. Read 600-lb. jacketed ribbon mixer. Large stock stainless steel tanks and kettles. PERRY EQUIPMENT CORP., 1424 N. 6th St., Philadelphia 22, Pa.

REBUILT BANBURY BODIES AND PARTS FOR SALE OR INterchange. Sizes #9 and #11 complete bodies available. Extra parts include rotors, door tops, and rings. We rebuild all sizes of Banburys and can also fabricate any parts needed. Our "Pre-Plan" rebuilding method saves your production time. Write for prices and details. INTERSTATE WELDING SERVICE, Offices, Metropolitan Bldg., Akron 8, Ohio.

FOR SALE: RUBBER PRESS, STEAM, 3 OPENINGS, PLATENS 18 x 28, used two years. $800.00. 5 HP. Parker gas-fired boiler, used two years. $250.00. C. BUNKER, Bloomingdale, Ill.

FOR SALE: 3-ROLL CALENDER WITH 14" X 41" ROLLS. NO drive. Address Box No. 1255, care of INDIA RUBBER WORLD.

WATSON-STILLMAN PUMPING UNIT WITH VICKERS RADIAL Pump—5 HP., 1160 RPM, 220, 3-Phase Motor, 60 cycles. Large tank with oil cooler. Brand new. Price $1,200.00—25% less than cost. THE CELLO CO., 350 W. 31st St., New York 1, N. Y.

HOWE MACHINERY CO., INC.
30 GREGORY AVENUE PASSAIC, N. J.
Designers and Builders of
"V" BELT MANUFACTURING EQUIPMENT
Cord Latexing, Expanding Mandrels, Automatic Cutting, Skiving, Flipping and Roll Drive Wrapping Machines.
ENGINEERING FACILITIES FOR SPECIAL EQUIPMENT
Call or write.

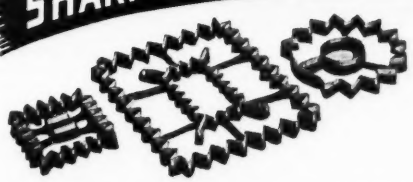
STEEL CALENDER STOCK SHELLS

ALL STEEL, ALL WELDED CONSTRUCTION, with forged steel hubs for 1¼", 1½" and 2" square bars. 4", 5", 6", 8", 10", 12", 15", 20" and 24" diameters. Any length. Also Special Trucks (Leaf Type) Racks, Tables and Jigs.

Used in manufacturing rubber and plastic products.

THE W. F. GAMMETER COMPANY
CADIZ, OHIO

SHARP EDGE CUTTING DIES



DIC

Also* PERFORATING TUBES and COLLETS *of all types

INDEPENDENT DIE & SUPPLY COMPANY
LaSalle & Ohio Sts. • St. Louis 4, Missouri

RUBBER MACHINERY

MILLS
22 x 72"
22 x 60"
22 x 48" (heavy duty)
18 x 45" (several)
18 x 30"
16 x 40" (several)
16 x 30"
16 x 24"
6 x 12" (used lab)
6 x 12" (new lab)
8 x 18"
10 x 24"

HYDRAULIC PRESSES
24 x 24", 12" ram
24 x 24", 14" ram
30 x 30", 16" ram
48 x 48", 4-14" rams, 8 openings
12 x 12"
We also furnish new ARMACO presses of the following sizes:
12 x 12" 36 x 36"
18 x 18" 42 x 42"
24 x 24" 48 x 48"
32 x 32"
Also larger sizes, all presses having large diameter rams.

CALENDERS
24 x 66" 3-roll
22 x 60" 3-roll
18 x 54" 3-roll
16 x 40" 3-roll
12 x 30" 4-roll
10 x 20" 3-roll
6 x 12" New lab

BANBURY MIXERS
Nos. 1, 1A, 3, 3A, 9 & 11

EXTRUDERS
1", 2", 3¼", 4½", 6", 8", 12" all with motors and drives

VULCANIZERS
All sizes, new and used, with quick opening door.

BUYS OF THE MONTH ★

MISCELLANEOUS
Refiners, Crackers, Choppers, and Grinders
Black Rock Washer Cutters—Gears, Gear Reducers
36" Ferriot Stock Cutter, almost new
4M Black Rock Stock Cutters
Hydraulic Pumps—high and low pressure Units (all types available)

FOR THE BEST DEAL IN NEW AND USED RUBBER WORKING MACHINERY, CALL US OR STOP IN AT OUR LOCATION CLOSE TO DOWNTOWN AKRON.

ARMACO

AKRON RUBBER MACHINERY CO., INC.
200 South Forge St. • P.O. Box 88 • Akron 9, Ohio • PHONE HEmlock 9141

For SALE

1—Banbury #1 Mixer with 50 HP Motor.
1—Baker Perkins Laboratory Size 6, Class BB, 2 Gal., Internal Rubber Mixer.
1—Stewart Bolling 2-roll Lab. Mill, 6" x 12".
1—Thropp 2-roll Rubber Mill 10" x 24".
2—Thropp 2-roll Rubber Mills, 18" x 50".
1—Thropp 2-roll Rubber Mill, 14" x 30".
1—Adamson Vulcanizer, 2' x 4' with quick opening door.
1—Adamson Vulcanizer, 6' x 20' with quick opening door.
1—Adamson Vulcanizer, 2' x 12' with quick opening door, 150 lbs. W. P.
1—Ball & Jewell Stainless Steel #0 Rotary Cutter with Motor and Starter.
1—Paul O. Abbe #2 Master Rotary Cutter with Ball Bearings.
1—Welding Engr. Stainless Steel #2 Extruder.
1—Sprout Waldron Attrition Mill, Type 36 with 2-75 HP Motors.

WE ARE INTERESTED IN PURCHASING ALL TYPES OF RUBber machinery consisting of mills, Banbury mixers, extruders, calenders, vulcanizers, etc., and also complete plants.

R. GELB & SONS, INC.
UNION, N. J. UNIONVILLE 2-4900

RUBBER HARDNESS
THE LANGUAGE OF THE RUBBER INDUSTRY SINCE 1915
DUROMETER
VARIOUS MODELS FOR TESTING THE ENTIRE RANGE
TECHNICAL DATA ON REQUEST
THE SHORE INSTRUMENT & MFG. CO., INC.
90-35 VAN WYCK EXPRESSWAY
JAMAICA 2, N. Y.

(Classified Advertisements Continued on Page 717)

RAYON

A SURVEY of the domestic rayon producing industry shows that current production of viscose high-tenacity yarn is at the rate of 457,000,000 pounds a year. With expanded facilities, this figure is expected to rise to a level of about 510,000,000 pounds a year by late 1954. Overall synthetic fiber capacity is currently placed at 1,838,000,000 pounds a year, and this total is expected to increase 24% by late 1954.

Third-quarter, 1952, production of rayon tire cord and fabric totaled 98,000,000, pounds, unchanged from the preceding quarter. During the third quarter there were also 10,000,000 pounds of cotton tire cord, 3,000,000 pounds of nylon tire cord, and 9,000,000 pounds of cotton chafer fabric produced. Total tire cord and fabric production, therefore was 120,000,000 pounds for the quarter. This total was the lowest since 1949, but the decline was directly attributable to reductions in cotton tire cord and fabric production. Cotton now claims only about 9% of the tire market.

No changes were made in rayon tire cord and fabric prices during the period from December 16 to January 15, and current prices follow:

Rayon Prices

Tire Yarns

1100/ 480	$0.63
1100/ 490	.62
1150/ 490	.62
1650/ 720	.62
1650/ 980	.61
1900/ 980	.61
2200/ 960	.61
2200/ 980	.60
4400/2934	.63

Tire Fabrics

1100/490/2	.72
1650/980/2	$0.659 / .73
2200/980/2	.685

COTTON AND FABRICS

NEW YORK COTTON EXCHANGE
WEEK-END CLOSING PRICES

Futures	Oct. 25	Nov. 29	Dec. 20	Dec. 27	Jan. 3	Jan. 10
Mar.	36.36	35.43	33.55	33.66	33.91	33.15
May	36.52	35.82	34.07	34.14	34.45	33.52
July	36.34	35.93	34.36	34.40	34.75	33.74
Oct.	34.98	34.66	34.13	34.12	34.25	33.72
Dec.	34.90	34.61	34.07	34.10	34.22	33.75
Mar.	34.93	34.60	34.06	34.11	34.26	33.75

IRREGULAR price movements with a downward trend, and light trading highlighted the market on the New York Cotton Exchange during the period from December 16 to January 15. Activity was concentrated in the old crop months, and weakness in those months were aggravated by switchings to later positions. Other factors behind the price decline included the continuing slow export activity, reports that Brazil will sell a large quantity of cotton at the world price level, and the generally lagging commodity markets.

The spot price for 15/16-inch middling cotton began the period at 33.20¢, rose to a high of 33.75¢ on January 2, fell to a seasonal low of 32.40¢ on January 12, and recovered to end the period at 33.20¢. Future prices showed corresponding movements, but were somewhat firmer so that differentials over the spot price continued to widen.

Fabrics

The cotton gray goods market began the period at a high level of business, slumped at the year-end, then recovered somewhat during the first half of January. Most business was concentrated in wide industrial fabrics, including twills, sateens, ducks, and drills, and heavy sales were made into March. Government procurements for ducks tapered off after the first of the year, and production fell back to more normal levels.

Demand for hose and belting ducks and chafer fabrics was light and irregular, and further price reductions were made by mills in the second week of January.

Cotton Fabrics

Drills

59-inch 1.85-yd.	yd.	$0.40 / $0.425
2.25-yd.		.355 / .36

Osnaburgs

40-inch 2.11-yd.	yd.	nom.
3.65-yd.		.155 / .1575

Ducks

38-inch 1.78-yd S. F.	yd.	nom.
2.00-yd D. F.		nom.
51.5-inch, 1.35-yd. S. F.		nom.
Hose and belting		.67

Raincoat Fabrics

Print cloth, 38½-inch, 64x60	yd	.15 / .155
Sheeting, 48 inch, 4.17-yd.		.22
52-inch 3.85-yd.		.245

Chafer Fabrics

14-oz./sq. yd. Pl.	lb.	.73
11.65-oz./sq. yd. S.		.65
10.80-oz./sq. yd. S.		.6875
8.9-oz./sq. yd. S.		.7025

Other Fabrics

Headlining, 68-inch 1.35-yd., 2-ply	yd.	nom.
68-inch, 1.25-yd, 2-ply		.67
Sateens, 53-inch 1.32-yd.		.60
58-inch 1.21-yd.		.68

Tire Cords

K. P. std., 12-4-2	lb.	.85

Estimated Automotive Pneumatic Casings and Tube Shipments, Production, Inventory, November, October, 1952; First 11 Months, 1952-1951

Passenger Casings	November, 1952	% of Change from Preceding Month	October, 1952	First Eleven Months, 1952	First Eleven Months, 1951
Shipments					
Original equipment	2,187,777		2,634,799	21,656,290	25,289,913
Replacement	2,432,817		3,583,593	43,077,723	32,422,776
Export	42,066		58,625	659,084	655,961
TOTAL	4,662,660	−25.72	6,277,017	65,393,097	58,368,650
Production	6,070,801	−15.51	7,185,388	67,921,492	60,672,660
Inventory end of month	9,612,240	+16.60	8,243,888	9,612,240	5,422,543
Truck and Bus Casings					
Shipments					
Original equipment	477,690		565,140	4,911,084	5,062,803
Replacement	705,272		948,253	8,149,502	9,670,145
Export	43,949		55,116	724,614	822,938
TOTAL	1,226,911	−21.78	1,568,509	13,785,200	15,555,886
Production	1,313,199	−11.15	1,478,042	14,655,903	16,291,054
Inventory end of month	2,659,464	+ 3.18	2,577,525	2,659,464	1,465,456
Total Automotive Casings					
Shipments					
Original equipment	2,665,467		3,199,939	26,567,374	30,352,716
Replacement	3,138,089		4,531,846	51,227,225	42,092,921
Export	86,015		113,741	1,383,698	1,478,899
TOTAL	5,889,571	−24.93	7,845,526	79,178,297	73,924,536
Production	7,384,000	−14.77	8,663,430	82,577,395	76,963,714
Inventory end of month	12,271,704	+13.40	10,821,413	12,271,704	6,887,999
Passenger (Including Motorcycle) and Truck and Bus Tubes					
Shipments					
Original equipment	2,666,839		3,197,891	26,560,955	30,349,294
Replacement	1,898,169		2,602,052	31,030,535	30,653,233
Export	51,670		59,495	957,725	947,930
TOTAL	4,616,678	−21.21	5,859,438	58,549,215	61,950,457
Production	5,116,681	−17.74	6,220,157	59,395,456	62,106,242
Inventory end of month	10,909,946	+ 5.04	10,386,136	10,909,946	8,378,457

NOTE: Cumulative data on this report include adjustments made in prior months.
SOURCE: The Rubber Manufacturers Association, Inc., New York, N. Y.

Foreign Trade Opportunities

Supplementary information, in the form of literature, catalogs, photographs, price lists, or samples, is available in specific instances from the Commercial Intelligence Division, United States Department of Commerce, Washington 25, D. C.

Export Opportunities

Elastik Gummi- und Bekleidungswerk Mueller & Co., K.G., 41 Elbestrasse Osnabrueck-Hafen, Germany: breath-protection masks or gas masks.

Bruga S.r.l, 30 Via Bolzano, Milan, Italy: abrasives.

Allen H. Burdick, Av. Morelos No. 45, Office No. 103, Mexico D.F., Mexico: transmission equipment, V-belts and pulleys.

Gustave Dulcino, 42 Rue Karel Ooms, Antwerp, Belgium: rubberized paints.

Reifen-Plate, 71 Groepelinger Deich, Bremen, Germany: new and used tires for trucks, passenger cars, and industrial vehicles.

Fernando Von Rossum, Edificio I. Garza, Despacho 510, (Apartado Postal 329), Monterrey, Mexico: plastics and related lines.

Roy Gibbons Agencies, 803 Memorial Ave., Port Arthur, Ont., Canada: belt hocks and fasteners for rubber belting, connectors and clamps for rubber hose.

Handelmaatschappij "ATICO," N.V., 157 Stadhouderskade, Amsterdam, Netherlands: automobile parts and accessories, tires, garage equipment including demounting and vulcanizing apparatus, tire spreaders, jacks.

Manfred Engel, representing Irving Zapp Co., S.A., 31 Avenida Jose F. de la Ossa, (P. O. Box 1382), Panama: plastic goods including raincoats and shower curtains; toys and sporting goods.

Alexander Niemann, 38 Oktaviostrasse, Hamburg-Wandsbek, Germany: raw, synthetic, and scrap rubber.

Schoeninger & Co., 200 Ruffinstrasse, Landshut/Sued, Bavaria, Germany: bare rubber thread.

A. J. C. Nijstad, 2 Groenteweg, The Hague, Netherlands: second-hand passenger and truck tires.

Albert Taragano, representing Turkish American Trading, Ltd., 25 Tramway Durago, Harbiye, Istanbul, Turkey: tires, automotive supplies and spare parts.

Anton E. Nielsen & Co., 63 A Bredgade, Copenhagen, Denmark: orlon and dacron fabrics for making rainwear.

Ernest G. Pratt, representing Free State Mining & Finance Corp., Ltd., Cape House, 54 Fox St., P. O. Box 4280, Johannesburg, Union of South Africa: rubber moldings, rubberized clothing, footwear, light chemicals.

CLASSIFIED ADVERTISEMENTS

Continued

MACHINERY AND SUPPLIES WANTED

WANTED—TO EXPEDITE PRODUCTION—RUBBER MAKING machinery including Banbury Mixers, Heavy-Duty Mixers, Calenders, Rubber Rolls & Mixers, Extruders, Grinders & Cutters, Hydraulic Equipment, Rotary and Vacuum Shelf Dryers, Injection Molding Machines. Will consider a set-up plant now operating or shut down. When offering, give full particulars. P. O. Box 1351, Church Street Sta., New York 8, N. Y.

WANTED: USED TWO-ROLL RUBBER MILL 22" X 60", COMplete with motor, drive, brake and controls. Address Box No. 1249, INDIA RUBBER WORLD.

WANTED: USED AUTOCLAVE 72" to 84" DIAMETER X 15' long. Please advise what you have. ALLIANCE RUBBER COMPANY, Alliance, Ohio.

The Classified Ad Columns of INDIA RUBBER WORLD bring prompt results at low cost.

BUSINESS OPPORTUNITIES

MODERN MECHANICAL MOLDED GOODS PLANT HAS OPEN press time available. If you are interested, please send us particulars on the products, size of molds, and volume desired. Address Box No. 1256, care of INDIA RUBBER WORLD.

HUNDREDS of MILLIONS, DOLLARS

Want Corporation or Group that has $500,000. available, willing to use it as working capital, to such party an exclusive contract is available to process and market a high grade natural industrial filler, used in manufacture of rubber, plastics, paints, polishes and hundreds of other articles. 50 year supply available. Qualified, investigate. Write C. G. Nitz, 212 N. 64th St., Milwaukee 13, Wisc.

CUSTOM CALENDERING & SLITTING

Rubber, synthetic and plastic calendering. All work done under careful supervision and laboratory control. For full information, please address reply to:

BISHOP MFG. CORP., 10 Canfield Road, Cedar Grove, N. J.

CUSTOM MIXING

Surplus capacity available to customers' specifications on No. 3A Banbury Type Machine. We are manufacturers of Molded, Lathe Cut, and Extruded Soft Rubber Goods and have surplus mixing capacity.

MARTIN RUBBER COMPANY
Long Branch Ave., Long Branch, N. J.
Telephones: Long Branch 6-1221-1222

CUSTOM MIXING

We do mixing of compounds of rubber, all types of synthetics, and plastics. Both Banbury and mill mixing capacity are available. Formulation assistance rendered.

K. B. C. INDUSTRIES, INC.

881 State St., New Haven, Conn. Phone 7-5662
Otto J. Lang, General Mgr.

WANTED

A NEW CHEMICAL PRODUCT

A successful chemical and pigment sales company with an adequate technical background will consider the promotion and sale of a *new* chemical product of provable value in compounding rubber or plastics.

Or, if you have an idea beyond the embryonic stage but not yet at the point of immediate commercial usefulness, we will consider assisting you in its final development providing in our judgment the potential market is substantial.

Answers to this advertisement will be treated in strict confidence, and in any case, your inquiry will be acknowledged. Our own employees know of this advertisement.

Address Box 1237, India Rubber World.

CUSTOM MIXING

We do milling and compounding of all types — blacks or colors — Master Batches —
All mixing done under careful supervision and laboratory control.

PEQUANOC RUBBER CO.
Phone: Butler 9-0400 BUTLER, NEW JERSEY

MANUFACTURING BUSINESS WANTED

We are now manufacturing over $20,000,000 in various lines and wish to expand by acquisition of assets or stock of one or more industrial companies. In our negotiations the sellers' problems and wishes will receive full consideration. Present personnel will normally be retained.
Address all replies "confidentially" C. J. GALE, Sec., 233 Broadway, New York 7, N. Y. BArclay 7-1819.

Rubber Plastic Synthetics
Precision Workmanship

CALENDERING & MIXING

Rubber & Plastics: Calendering, Mixing, Grinding & Pulverizing
AS YOU WANT IT. QUICK SERVICE
The Elm City Rubber Co. P.O. Box 1864
New Haven, Conn. Tel. Spruce 7-3437

"ANNALS OF RUBBER"

50c. per copy—
India RUBBER WORLD

A Chronological Record of the Important Events in the History of Rubber

386 FOURTH AVENUE
NEW YORK 16, N. Y.

U. S. Imports, Exports, and Reexports of Crude and Manufactured Rubber

Imports for Consumption of Crude and Manufactured Rubber

	September, 1952 Quantity	Value
UNMANUFACTURED, Lbs.		
Crude rubber	106,839,458	$28,223,624
Latex	8,542,170	2,771,909
Balata	243,760	51,414
Jelutong or Pontianak	321,384	183,692
Gutta percha	33,600	12,291
Synthetic rubber	4,722,878	1,181,007
Reclaimed rubber	620,149	39,551
Scrap rubber	1,857,025	52,414
TOTALS	123,180,424	$32,515,902
MANUFACTURED		
Rubber tires		
Auto, etc.	1,905	$48,294
Bicycle...no.	10,051	10,141
Other...no.	30	796
Inner tubes		
Auto, etc...no.	281	1,559
Footwear: boots...prs.	26,637	81,142
Shoes and overshoes, prs.	18,847	16,781
Rubber-soled canvas shoes...prs.	8,749	4,443
Athletic balls		
Golf...no.	10,080	2,529
Other, except tennis, no.	830	185
Hard rubber goods		
Combs...no.	7,416	1,153
Drug sundries	.....	668
Other	.....	11,160
Rubberized printing blankets...lbs.	2,220	5,034
Rubber toys	.....	37,411
And cotton friction tape...lbs.	5	7
Packing...lbs.	6,789	9,911
Gaskets and valve packing	.....	291
Molded insulators	.....	313
Belting...lbs.	5,838	8,595
Hose and tubing	.....	2,225
Gloves...prs.	32,520	7,990
Nipples and pacifiers gr.	2,820	3,652
Instruments	.....	3,270
Heels and soles...lbs.	3,000	797
Bands...lbs.	2,437	1,844
Other	.....	15
Gutta percha manufactures...lbs.	82	76
Synthetic rubber products	.....	14,057
Other soft rubber goods	.....	90,252
TOTALS	.....	$364,591
GRAND TOTALS, IMPORTS	.....	$32,880,493

Exports of Domestic Merchandise

	September, 1952 Quantity	Value
UNMANUFACTURED, Lbs.		
Chicle and chewing gum bases	316,263	$139,756
Balata, gutta percha, etc.	1,000	2,820
Synthetic rubbers		
GR-S type	570,110	151,827
Butyl	4,000	830
Neoprene	2,532,893	1,004,179
Nitrile types	346,067	183,238
Other	70,920	75,703
Reclaimed rubber	1,925,585	169,372
Scrap rubber	2,629,857	67,745
TOTALS	8,396,695	$1,795,470
MANUFACTURED		
Rubber cement...gals.	80,743	$155,385
And rubberized fabric...sq. yds.	145,362	129,161
Clothing	.....	149,831
Footwear		
Boots and shoes..prs.	13,466	40,239
Rubber soled canvas shoes...prs.	12,429	24,177
Heels...doz. prs.	39,708	54,256
Soles, soling, toplift sheets...lbs.	600,194	162,841
Gloves and mittens...doz. prs.	11,911	52,425
Drug sundries	.....	165,790
Toys, balls, novelties	.....	78,249
Hard rubber goods		
Battery boxes...no.	35,098	42,131
Other electrical...lbs.	137,258	90,925
Other	.....	31,396
Rubber tires and casings		
Truck and bus...no.	56,745	2,957,894
Auto and motorcycle...no.	97,407	1,182,388
Aircraft...no.	1,588	78,373
Off-the-road...no.	11,100	1,177,461
Farm tractor...no.	6,248	243,430
Implement...no.	2,597	51,635
Other...no.	3,858	22,842
Inner tubes		
Auto...no.	74,721	130,528
Truck and bus...no.	29,504	124,335
Aircraft...no.	1,268	8,940
Other...no.	13,181	45,368
Solid tires: truck and industrial...no.	2,099	24,861
Tire repair material		
Camelback...lbs.	474,501	148,838
Other...lbs.	327,722	309,155
Tape, except medical and friction...lbs.	26,928	22,299
Belting: V-type auto lbs.	62,153	90,062
Transmission V-type...lbs.	99,935	228,801
Flat belts...lbs.	34,393	51,205
Conveyor and elevator...lbs.	219,546	200,874
Other...lbs.	11,448	18,398
Hose: molded and braided...lbs.	276,606	217,762
Wrapped and hand built...lbs.	102,118	91,015
Other hose and tubing...lbs.	81,146	99,722
Packing		
Sheet type...lbs.	37,850	24,693
Other...lbs.	152,059	177,815
Tiling and flooring...lbs.	180,637	47,587
Mats and matting...lbs.	599,902	168,510
Thread, bare...lbs.	8,856	14,197
Textile covered...lbs.	5,979	16,611
Compounded rubber for further manufacture lbs.	1,048,128	294,796
Other rubber manufactures	.....	493,388
TOTALS	.....	$9,948,589
GRAND TOTALS, ALL RUBBER EXPORTS	.....	$11,744,059

SOURCE: Bureau of Census, United States Department of Commerce, Washington, D. C.

Reexports of Foreign Merchandise

	September, 1952 Quantity	Value
UNMANUFACTURED, Lbs.		
Crude rubber	624,109	$202,978
Balata, gutta percha, etc.	23,500	12,054
TOTALS	647,609	$215,032
MANUFACTURED		
Rubber drug sundries	.....	$1,110
Toys, balls, novelties	.....	105
Tires and casings		
Auto and motorcycle no.	12	132
TOTALS	.....	$1,347
GRAND TOTALS, ALL RUBBER REEXPORTS	.....	$216,379

Compounding Ingredients— Price Changes and Additions

Accelerator-Activators, Inorganic

Litharge, Eagle...lb.	$0.1675	/	$0.1685
National Lead...lb.	.175	/	.176
Red lead, Eagle...lb.	.1775		
National Lead...lb.	.185	/	.1875
White lead, basic:			
Eagle and National Lead lb.	.17	/	.18
White lead silicate, Eagle lb.	.1825	/	.20
National Lead...lb.	.155	/	.165

Accelerator-Activators, Organic

Emersol 110...lb.	.11	/	.1225
120...lb.	.115	/	.1275
130...lb.	.1375	/	.15
210 Elaine...lb.	.1125	/	.1425
Emery 600...lb.	.1025	/	.1325

Carbon Blacks

(MT) Sterling MT...lb.	.035		

Chemical Stabilizers

Eagle White Lead Silicate			
#201...lb.	.19	/	.20
202...lb.	.1825	/	.1925

Colors, White — Zinc Oxide

Aso 35% leaded...lb.	.147	/	.157
50% leaded...lb.	.1485	/	.1585
Eagle 35% leaded...lb.	.147	/	.157
50% leaded...lb.	.1485	/	.1585
Lehigh 35% leaded...lb.	.147	/	.157
50% leaded...lb.	.1485	/	.1585

Latex Compounding Ingredients

Webnix #34...lb.	1.50	/	2.25

Plasticizers and Softeners

Darex Plasticizer DBM...lb.	.30	/	.3275

United States Rubber Statistics — October, 1952

(All Figures in Long Tons, Dry Weight)

	New Supply Production	Imports	Total	Distribution Consumption	Exports	Month-End Stocks
Natural rubber, total	0	50,761	50,761	39,199	337	76,547
Latex, total	0	4,890	4,890	5,911	0	6,314
Rubber and latex total	0	55,651	55,651	45,110	337	82,861
Synthetic rubbers, total	*55,008 †7,545	2,101	64,654	73,963	1,507	133,042
GR-S types‡	*49,374 †5	1,892	51,271	60,651	287	96,962
Butyl	*5,634	209	5,843	6,595	73	24,401
Neoprene‡	†5,840	0	5,840	5,408	945	8,059
Nitrile types‡	§11,700	0	1,700	1,309	202	3,620
Natural rubber and latex, and synthetic rubbers, total	62,553	57,752	120,305	119,073	1,844	215,903
Reclaimed rubber, total	27,405	207	27,612	26,830	806	31,463
GRAND TOTALS	89,958	57,959	147,917	145,903	2,650	247,366

*Government plant production.
†Private plant production.
‡Includes latices.
§Estimated.
SOURCE: Rubber Division, NPA, United States Department of Commerce, Washington, D. C.

Trade Lists Available

The Commercial Intelligence Division recently published the following trade lists, of which mimeographed copies may be obtained by firms domiciled in the United States from this Division and from Department of Commerce Field Offices. The price is $1 a list for each country.

Aircraft & Aeronautical Supply & Equipment Importers & Dealers—Australia.

Automotive Product Manufacturers—Canada; Ecuador; Greece; Sweden; Union of South Africa.

Automotive Vehicle & Equipment Importers & Dealers—Australia; Austria; Ceylon; Greece; Haiti; Mexico; New Zealand; Norway; Portugal; Venezuela.

Boot & Shoe Manufacturers & Exporters—Uruguay.

Chemical Importers & Dealers—India; Mozambique.

Chemical, Synthetic Organic, Manufacturers—United Kingdom.

Electrical Supply & Equipment Importers & Dealers—Venezuela.

Plastic Material Manufacturers, Molders, Laminators & Fabricators—Cuba.

Rubber Goods Manufacturers — Finland; France; Venezuela.

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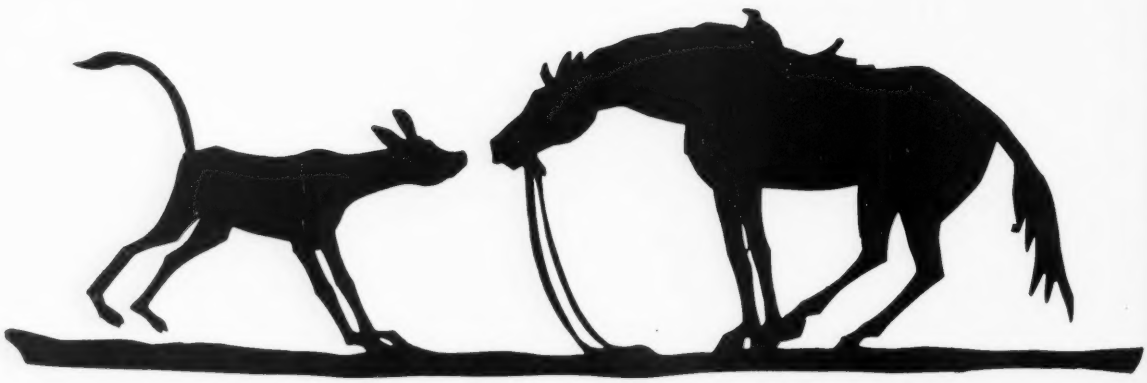

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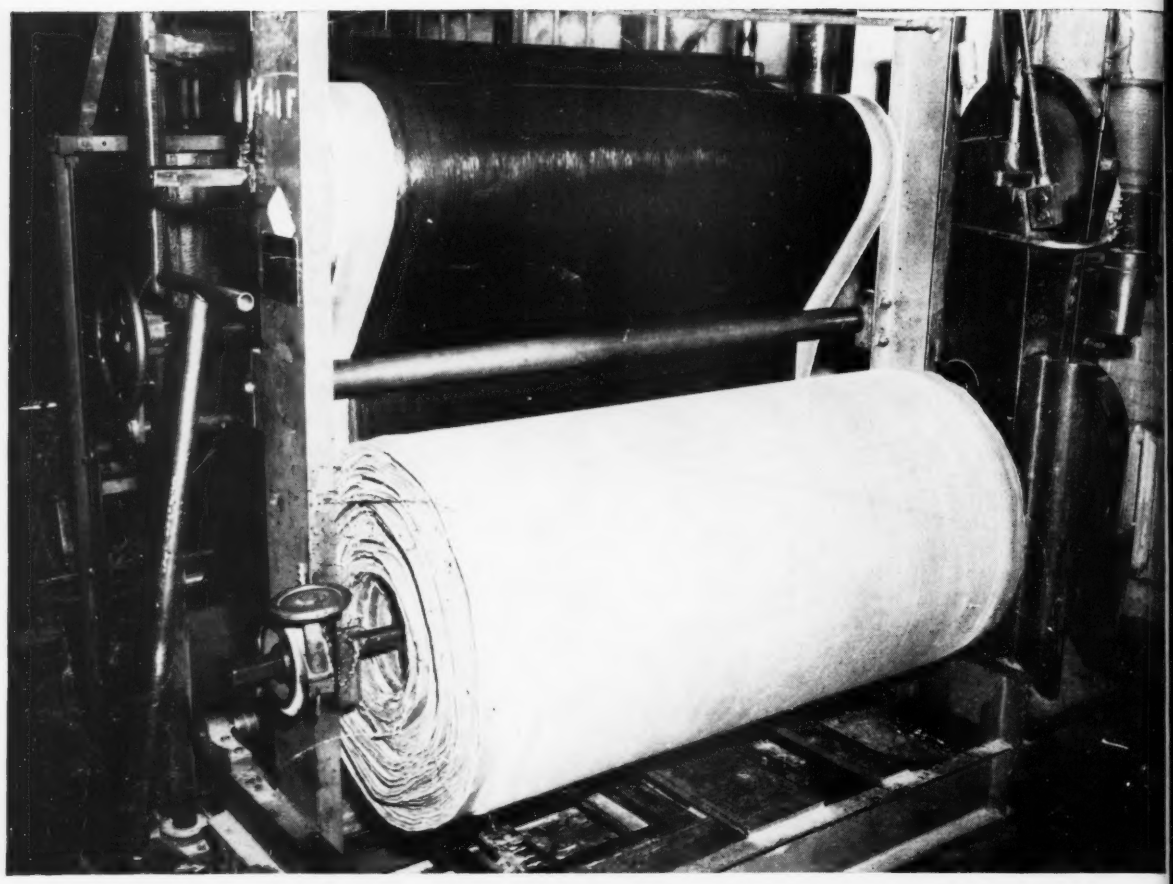

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